Published by The College of Agriculture and Hospitality Management (COAHM), TASFUED, vol. 1, no. 1, pp. 88-110

JOAHM, TASFUED
Journal of Agriculture and Hospitality Management

Evaluation of anthelmintic potentials of *Vernonia amygdalina* and *Dennettia tripetala* against gastrointestinal parasite (*Haemonchus contortus*)

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Abstract
Livestock farming is one of the major sources of income in communities, it is often threatened by gastrointestinal helminthic infections. This study investigates anthelmintic potential of *V. amygdalina* and *D. tripetala* against gastrointestinal parasite (*Haemonchus contortus*), one of the pathogenic parasites causing disease in ruminant animals. A total of 24 male West Africa Dwarf goats were divided into six groups of four animals each and orally infected with 500 infective third stage (L_3) larvae of *H. contortus.* Extracts of *V. amygdalina* and *D. tripetala* were administered at 2,000 mg/mL and 4,000 mg/mL to infected goats, while albendazole and distilled water were used as positive and negative controls respectively. Faecal egg count, chemo suppression, haematological, biochemical and deparasitization rates were determined in the infected goats. Administration of 4,000 mg/mL extract of *D. tripetala* resulted in the lowest faecal egg count and the highest chemossuppression (92.42%), whereas *V. amygdalina* at 4,000 mg/mL had a higher faecal egg count and lowest chemossuppression (88.71%). The PCV, Hb, and RBC values of untreated infected animals were significantly lower ($p<0.05$) than those of treated animals. The biochemical results revealed significant increases in glucose, albumin, and urea levels in treated infected animals, while creatinine, AST and ALT levels were reduced in the treated infected animals. The results showed that both plants possess anthelmintic potential against *H. contortus* in goats. Incorporating these plants into animal feed and pharmaceutical preparations could be an important strategy for reducing the prevalence of helminthic infections in livestock.

Keywords: Chemosuppression, Aspartate aminotransferase (AST), Alanine aminotrasferase, (ALT), Packed Cell Volume, (PCV), Haemoglobin (Hb), Red Blood Cell (RBC)

1. Introduction

Livestock farming and trading of domestic animals are major sources of income in rural communities across Nigeria. One of the major constraints to the sustainable availability and productivity of these animals is parasitic infections. These parasites inhabit the gastrointestinal tract of many animals and have become some of the most difficult organisms to control in ruminants because of their rapid reproduction and the large number of eggs produced by single adult worm. (Usman *et al.,* 2026).

Gastrointestinal (GI) parasitic infections among livestock are a worldwide problem for both small and large scale farmers. These parasites cause considerable economic losses to livestock-rearing communities. A high prevalence of gastrointestinal parasite presents a significant threat to public health and livestock production. They cause great loss to communities, affecting their gross domestic income and negatively influencing growth and developments (Mapagha-Boundoukou *et al*., 2025).

Nematodes are among the most prevalent parasites affecting both humans and animals worldwide. Among these parasites, *Haemonchus contortus*, commonly referred to as the barber's pole worm, is one of the most pathogenic nematodes infecting ruminant animals. It inhabits the abomasum, where it feeds on blood by penetrating the abomasal wall, thereby causing anaemia, reduced productivity, and mortality (Isah *et al*., 2026). It causes an infection known as haemonchosis which is commonly observed in areas with seen in conducive climatic conditions and high humidity. Haemonchosis is primarily a disease of tropical and subtropical regions. High humidity enhances the survival of the parasite in animal faeces and herbage. The major impact of *H. contortus* infection in small ruminants is associated with its blood-feeding activity. The parasite is responsible for extensive blood loss, with each adult worm reportedly consuming approximately 0.05 milliliter of blood per day (Regassa *et al*., 2024).

Rotimi, P. I., Ojo, F. T., Ettu, R. O. & Otegbade, A. C. (2026). Evaluation of anthelmintic potentials of *Vernonia amygdalina* and *Dennettia tripetala* against gastrointestinal parasite (*Haemonchus contortus*), *Journal of Agriculture and Hospitality Management (JOAHM),* vol. 1, no. 1, pp. 88-110.
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Resistance of helminths to numerous anthelmintic drugs is becoming increasingly worrisome, and the development of resistance to these drugs has become a major challenge to animal health and production. *H. contortus* has evolved different strategies to evade the host immune response during infection, enabling it to establish long-term infection and induce significant inflammatory responses. This has been attributed to the release of complex excretory/secretory protein (ESP) mixtures into host tissues, which may interfere with host signalling mechanisms and immune homeostasis (Ahmad *et al.,* 2024).

The use of plants as remedies for treating parasitic infections is becoming an important alternative approach for the effective control and management of parasitic diseases. Bioactive compounds identified in plants with antparasitic properties include flavonoids, tannins, saponins, alkaloids, and terpenoids (Agnes *et al.,* 2023).

Vernonia amygdalina is a plant that belongs to the family Asteeraceae and is native to tropical regions of Africa and Asia. It is known as "Ewuro" in Yoruba, "Onugbu" in Igbo, and "bitter leaf" in English. Its extracts contain alkaloids, tannins, flavonoids, saponins, triterpenoids, steroids, glucosides, and reducing sugars (Patathananon *et al.,* 2023). Extracts from *V. amygdalina* are used as tonics and in the treatment of diabetics, anorexia, diarrhoea and dysentery. The antioxidants present in bitter leaf can neutralize harmful free radicals, thereby minimizing the effects of cytotoxic substance in humans (Edo *et al.,* 2023).

Dennettia tripetala, commonly known as pepper fruit, belongs to the family of Annonaceae. It is called "Ata igbere" or "Igberi" in Yoruba and "Mimmi" in Igbo and is abundantly found in Nigeria. Its fruit and leaves are used in traditional medicine for the treatment of various ailments. The plant is consumed and used for medicinal purposes in western Africa (Omage *et al*., 2021). Extracts of *D. tripetala* fruits have been shown to contain potent antioxidant and phytochemical compounds (Mohammed *et al.*, 2021). Hence, this study investigates the efficacy of *V. amygdalina* and *D. tripetala* extracts against *H. contortus* in ruminant animals**.**

2. Materials and Methods

2.1 Plant Determination

Information on plants with potential anthelmintic properties was obtained through searches of online databases, including Google Scholar, Pubmed, Search strings, and MeSH and as well as through consultations with livestock farmers. Herbs frequently mentioned by the farmers and identified through the literature search as having potential anthelmintic properties were selected for *in vivo* evaluation of their anthelmintic activity against *Haemonchus contortus*.

2.2 Plant collection and extraction

Fresh leaves of *V. amygdalina* were obtained from Ayetoro, Epe, while fruits of *D. tripetala* were purchased from the fruit sellers at Ayetoro market, Epe, Lagos State. The plants were selected based on literature reviews of the traditional use of medicinal plants in Africa and other parts of the world. These plants have been reported to possess some phytochemicals.

The leaves of *V. amygdalina* and fruits of *D. tripetala* were identified and authenticated by a taxonomist in the Department of Botany, University of Ibadan. Voucher number UIH 23868 was assigned to *V. amygdalina,* while Voucher number UIH 23865 was assigned to *D. tripetala*.

The leaves of *V. amygdalina* and fruits of *D. tripetala* were air-dried at room temperature. The dried plant materials were ground into powder, and 200 g of each powdered plant material was dissolved in 2,000 mL of ethanol. The mixtures were allowed to stand at room temperature for 72 hours. The resulting extract solutions were filtered, transferred into evaporating dishes, and concentrated. The concentrated extracts were weighed to determine the percentage yield and stored at 25^0 C temperature until use (Isdore *et al.,* 2023).

2.3 Preparation of Stock Solutions

The crude extract of each plant was weighed, and 10 g was dissolved in 10 mL of distilled water to obtain a stock solution 1,000 mg/mL. From the stock solutions, 2,000 mg/mL and 4,000 mg/mL were prepared to determine the dose-dependent effect of the extracts which was used for the study. Albendazole was used as the positive control, while distilled water served as the negative control.

2.4 Source of *H. contortus*

Adult *Haemonchus contortus* was obtained from the abomasa contents of cattle slaughtered at Amosun Abattoir, Akinyele Local Government Area, Oyo State. Adult worms containing eggs of *H. contortus* were crushed and the resulting material was cultured to obtain infective third-staged larvae (L_3). A total of 500 infective L_3 larvae were used to infect goats, and faecal samples from the infected goats were examined for *H. contortus* eggs, after 14 days post-infection. These goats serve as donor.

2.5 Identification of *Haemonchus contortus*

Fresh faecal samples containing parasite eggs were obtained from the goats serving as donors and taken to the Department of Medical Microbiology and Parasitology, University College Hospital, Ibadan for DNA characterization of the isolate. The genetic material of the parasite was identified using polymerase chain reaction (PCR) amplification with primers targeting gene of interest. The Internal Transcribed Spacer2 region (ITS-2) region of the ribosomal RNA gene array of *H. contortus* was targeted, and accession number PZ569106 was assigned to the *Haemonchus contortus* isolate.

Table 1: Experimental Design for Administration of *Vernonia amygdalina* and *Dennettia tripetala* Extracts against *Haemonchus contortus* Larvae in Goats

Groups	Infection status	Treatment	Dose (mg/mL)	Duration
1	500 L_3 Larvae	*Vernonia amygdalina*	2000	10 Days
2	500 L_3 Larvae	*Vernonia amygdalina*	4000	10 Days
3	500 L_3 Larvae	*Dennettia tripetala*	2000	10 Days
4	500 L_3 Larvae	*Dennettia tripetala*	4000	10 Days
5	500 L_3 Larvae	Albendazole	400	Once
6	500 L_3 Larvae	Untreated	Distilled water	No treatment

2.6 Experimental Animals

A total of thirty-six (36) male West African Dwarf goats weighing between 20 to 23 kg were used for the experiment. The goats were deparasitized and faecal samples were examined to confirm that they were free from parasites before the administration of cultured larvae.

2.7 Ethical Approval

Approval for usage of animals in this study was obtained from the Ethical Review Board of Babcock University, Ilisan-Remo, Ogun State. The ethical approval number was BUHREC 038/25NB50. All National and Institutional guidelines for animal care and the proper disposal of collected animal waste were followed.

2.8 Coproculture of *Haemonchus contortus*

Fresh faecal sample from infected goats were crushed and sieved through a coffee strainer into a conical flask. The filtrate was transferred into centrifuge tubes and centrifuged at 2000 rpm for 3 minutes. The resulting sediment was spread in petri dishes containing filter paper and incubated at room temperature for seven (7) days, following the method described by Fakae & Ngongeh, (2013).

2.9 Harvesting and Enumeration of L_3

The petri dishes containing the smeared faecal filter papers were sprinkled with sufficient water to cover the filter papers. The cultures were kept for 30 minutes to allow the larvae to migrate into the water. The water containing the larvae was carefully transferred into test tubes. The L_3 larvae in the test tubes were washed three times with distilled water by centrifugation at 3,000 rpm for 3 minutes. The supernatant was removed using a pipette, leaving up to 500 µl of water to avoid disturbing the pelleted L_3 larvae. After the third wash, distilled water was added to make up the volume to exactly 2 mL. A 200 µL aliquot was aspirated and placed on a clean microscopic slide, and the number of L_3 larvae was counted 3 times using a light microscope at ×10 objective magnification (Reynolds *et al.,* 2015).

2.10 Infection of experimental animals

Prior to infection of the experimental animals, the larvae were counted to determine the number of infective larvae (L_3) of *Haemonchus contortus* harvested from the cultured goat faecal matter. A dose of 500 active infective larvae was suspended in 10 mL of distilled water. Each goat was restrained, and its mouth was slightly opened to administer the parasite. The animals were subsequently monitored, for signs and symptoms of parasitic infections for 14 days. At day 17 post infection, fresh faecal samples were collected from the animals and examined for faecal eggs count (FEC) of parasitic infection.

2.11 Acute Toxicity

Toxicity studies were conducted to determine the median lethal dose (LD_{50}) of the ethanol extracts of *Vernonia amygdalina* and *Dennettia tripetala* according to the modified method described by Lorke's (1983). Twelve (12) goats weighing 20 to 23 kg were used for the experiment. Each goat was orally administered graded doses of the plant extracts (1000, 3000, and 5000 mg/mL).The animals were monitored for signs of toxicity for 7 days (Ozioko *et al.,* 2022). Symptoms and possible side effects were monitored daily, and the number of surviving animals was recorded throughout the 7 days observation period (Ahmed, 2015).

2.12 Experimental Design for Anthelminthic studies

A total of twenty- four (24) male West African Dwarf goats weighing between 20 to 23 kg were used for the experiment. The goats were randomly assigned into 6 groups, with four goats in each group. Table 1 shows the experimental design, including the dose of L_3 larvae used to infect the goats and the treatments with the ethanol extracts of *Vernonia amygdalina* and *Dennettia tripetala*.

2.13 Faecal Egg Count

Faecal egg count (FEC) was carried out on day 17 of post-infection to determine the number of eggs per gram (EPG) of faeces in each goat using the method described by Ngonge & Fakae (2019). Two grams of faeces collected from each goat was sieved into a petri dish containing 28 mL of normal saline. The suspension was centrifuged at 3,000 rpm for 3 minutes, and the deposit was placed on a clean microscopic

Table 2: Acute Toxicity studies of *Vernonia amygdalina* and *Dennettia tripetala* ethanoic extracts in goat (mg/mL).

Dose (mg/mL)	*V. amygdalina*	*D. tripetala*	*V. amygdalina*	*D. tripetala*
	Number of Dead goat		Clinical signs	
1000	0	0	NOS	NOS
3000	0	0	NOS	NOS
5000	0	0	RIW	NOS

NOS – No observable sign.
RIW - Reduction in weight.

slide. Plant extracts were administered to the animals on day 23 post infection and the eggs per gram (EPG) of faeces were examined from day 25 post infection. The Egg per gram was calculated using the formula described by Zajac & Conboy (2013) as presented in Equation (1). The infected goats were humanely slaughtered on day 37 post-infection to determine the presence of parasites and the burden of adult worms.

$$EPG = N \times (\frac{T}{V})/F \quad (1)$$

where:
N = Average number of eggs counted
T = Total volume of faecal suspension /flotation
V = Volume of aliquot examined on the slide
F = Weight (in grams) of faecal sample used

2.14 Faecal Egg Count Reduction Test (FECRT)
The faecal egg count reduction (FECRT) was carried out from day 25 to day 35 post-infection to determine the efficacy of the treatments according to the formula described by Cavier *et al*., (1973) as presented in Equation (2).

$$\text{FECRT (\%)} = \frac{\text{Control FEC} - \text{Treated FEC}}{Control\ FEC} \times 100 \quad (2)$$

2.15 Post mortem worm count
On Day 37 post-infection, the infected goats were humanely slaughtered. The abomasum of each goat was removed and examined separately. The entire abomasum of each goat was opened and submerged into 100 mL of distilled water in a basin, and worms visible were counted. The percentage reduction in the total worm count was calculated according to the method by Enrizquez (1993) as presented in Equation (3).

Total Worm Count Reduction (TWCR)

$$TWCR(\%) = \frac{P-U}{P} \times 100 \quad (3),$$

where:
P = Total Worm Count in control group
U = Total Worm Count in treated group

2.15 Haematological Analysis
Three milliliters (3 ml) of blood was collected from the jugular vein of each goat by venipuncture into sample bottles containing ethylene diamine tetraacetate acid (EDTA) for haematological analysis. Haematology parameters, such as packed cell volume (PCV), hemoglobin (Hb), red blood cells (RBC), total white blood cell count (WBC), mean corpuscular volume (MCV), and mean corpuscular haemoglobin concentration (MCHC) were analysed according to the procedure described by Yohannes & Sharma (2019).

2.16 Biochemical Analysis
Three milliliters (3 ml) of blood was collected from the jugular vein of each goat by venipuncture into sample bottles containing lithium heparin. Serum biochemical parameters such as glucose, total protein, albumin, blood urea nitrogen, creatinine, aspartate amino transferase, (AST), and alanine aminotransferase (ALT) were analysed according to the procedures described by Bahran *et al*., (2011).

2.17 Data Analysis
Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 23.0 for windows. The data obtained were summarized as mean ± standard errors. Differences between means were determined using analysis of variance (ANOVA), with statistical significance at $p < 0.05$. A p-value of less than 0.05 was considered statistically significant at a 95% confidence interval.

3. Results
3.1 Toxicity studies
The acute toxicity of *Vernonia amygdalina* and *Dennettia tripetala* plant extracts was evaluated in goats to determine the toxic effect of these plants in goats meant for experimental study (Table 2). It was observed that both plants extract has no side effect on animals given the oral dose of plant extracts at 3,000 mg/mL. There was slight reduction in weight of goats given oral dose of *Vernonia amygdalina* at 5,000 mg/mL and no symptom was observed in goats given *Dennettia tripetala* orally at 5,000 mg/mL. Therefore, *Vernonia amygdalina* and *Dennettia amygdalina* can produce adverse reaction when administered above 5,000 mg/mL.

3.2 Egg per gram of faeces in goats treated with *Vernonia amygdalina* and *Dennettia tripetala*.
Egg per gram (EPG) of faeces in goats treated with *Vernonia amygdalina*, *Dennettia tripetala* and albendzole (Table 3) showed that at 25 day post infection animals given 2,000 mg/mL of *V. amygdalina* has the highest egg per gram, followed by *D. tripetala* administered at 2,000 mg/mL. *V. amygdalina* administered at 4,000 mg/mL, had the least egg per gram when compared to negative control among the extract treated group. The egg per gram of animals treated with *V. amygdalina* at 2,000 mg/mL on day 27

Table 3: Egg per gram of *H. contortus* in faeces of goats treated with *Vernonia amygdalina* and *Dennettia tripetala*

Treatment	DAY 25 P.I	DAY 27 P.I	DAY 29 P.I	DAY 31 P.I	DAY 33 P.I	DAY 35 P.I
***Vernonia amygdalina* 2000 mg/mL**	3245.33 ±41.19^{ab}	2787.67 ±98.90^{c}	2531.00 ±100.64^{d}	1953.67 ±64.79^{c}	1329.67 ±15.18^{b}	686.00 ± 9.85^{d}
***Vernonia amygdalina* 4000 mg/mL**	3161.33 ±83.77^{a}	2372.33 ± 73.55^{b}	2022.33 ±169.03^{c}	1846.00 ±56.31^{c}	912.67 ± 18.15^{a}	558.67 ±27.01^{c}
***Dennettia tripetala* 2000 mg/mL**	3243.67 ± 49.24^{ab}	2445.00 ±79.63^{bc}	1657.00 ±69.78^{b}	1460.33 ±106.28^{b}	931.33 ±30.24^{a}	478.67 ±15.86^{b}
***Dennettia tripetala* 4000 mg/mL**	3208.33 ±85.33^{a}	1521.00 ±72.55^{a}	1396.33 ±35.22^{a}	1269.33 ±46.58^{a}	900.67 ±30.07^{a}	375.33 ±22.19^{a}
Albendazole 400 mg/mL	3234.67 ± 53.15^{a}	2521.67 ±58.83^{c}	2440.00 ±55.87^{d}	1849.00 ±48.54^{c}	904.00 ±59.20^{a}	462.33 ± 21.83^{b}
NC	3358.00 ±7.51^{b}	3561.67 ±17.62^{e}	3721.33 ± 232.64^{e}	4143.33 ±123.44^{d}	4568.67 ± 83.56^{c}	4948.00 ±40.38^{e}

Columns with values bearing same superscript are not significantly different at p>0.05
P.I: POST INFECTION EPG – EGG PER GRAM

Table 4: Chemosuppression of *Vernonia amygdalina* and *Dennettia tripetala* extracts in goats infected with *H. contortus*

Treatment	Day 25 P.I (%)25	Day 27 P.I (%)	Day 29 P.I (%)	Day 31 P.I (%)	Day 33 P.I (%)	Day 35 P.I (%)
***Vernonia amygdalina* 2000 mg/mL**	3.23	16.77	31.99	52.85	70.90	86.14
***Vernonia amygdalina* 4000 mg/mL**	5.86	29.17	45.67	55.45	80.02	88.71
***Dennettia tripetala* 2000 mg/mL**	3.41	27.00	55.48	64.76	79.62	90.33
***Dennettia tripetala* 4000 mg/mL**	4.46	54.60	62.48	69.37	80.29	92.42
Albendazole	3.67	24.71	34.43	55.37	80.21	90.65

P.I – POST INFECTION CS- CHEMOSUPPRESSION

post infection showed the highest (p< 0.05) egg per gram, while *D. tripetala* administered at 4,000 mg/mL had the least egg per gram when compared with untreated group among the *extract* treated group. At 35 days post infection egg per gram, *V. amygdalina* administered at 2,000 mg/mL has the highest (p< 0.05) egg per gram, while *D. tripetala* administered at 4,000 mg/mL has the least egg per gram when compared with the untreated animals. However, *D. tripetala* showed to have the lowest egg count on the tenth day of extract administration.

3.3 Chemosuppression of *Vernonia amygdalina* and *Dennettia tripetala* extracts in goats infected with *H. contortus*.

The chemo suppressive activity of *Vernonia amygdalina* and *Dennettia tripetala* extracts against *H. contortus* (Table 4) showed that on day 25 post infection treatment, *Vernonia amygdalina* at 2,000 mg/mL has the least chemosuppresion, while *V. amygdalina* 4,000 mg/mL has the highest chemo suppression when compare to albendazole and untreated group. *Dennettia tripetala* 4,000 mg/mL has the highest chemo-suppression on Day 27 until day 35. On day 35, *Dennettia tripetala* 4,000 mg/kg and albendazole have the higher chemosuppression when compare to *Vernonia amygdalina* 4,000 mg/mL plant extract.

3.4 Haematological Indices

The haematological parameters of infected animals treated with *Vernonia amygdalina* and *Dennettia tripetala* plant extracts are shown in Table 5. The PCV, Hb and Neutrophil significantly increase in extract treated animals when compared to untreated animals. The highest PCV was recorded in *V. amygdalina* administered at 2,000 mg/mL while the lowest PCV was recorded in *D. tripetala* administered at 4,000 mg/mL among the extract treated groups. The PCV and neutrophils were higher (p<. 0.05) in animals administered *V. amygdalina* than in *D. tripetala.* There was a significant reduction (p<0.05) in eosinophil of animals treated with extracts of *V. amygdalina* and *D.*

Table 5: Haematological indices of infected goats treated with *Vernonia amygdalina* and *Dennettia tripetala*

Treatment	PCV (%)	Hb (g/L)	RBC ($\times 10^{12}$/L)	WBC ($\times 10^{12}$ /L)	Neutrophils (%)	Lymphocytes (%)	Eosinophils (%)	Monocytes (%)	Basophils (%)	MCV (fL)	MCHC (g/L)
Vernonia amygdalina 2000 mg/mL	21.67 ± 1.53^{c}	7.23 ± 0.57 ^{b}	5.77 ± 0.57^{c}	22500.00 ± 2505.99^{a}	23.97 ±8.61^{a}	66.03 ± 9.83^{a}	10.00 ± 2.00^{b}	00.00	00.00	24.37 ± 1.44^{b}	33.20 ±0.156^{c}
Vernonia amygdalina 4000 mg/mL	18.67 ±1.16^{b}	6.10 ±0.36^{b}	5.77 ± 0.84^{c}	21500.00 ±4450.84^{a}	28.33 ± 7.40^{a}	64.67 ±6.41^{a}	7.00 ± 1.00^{ab}	00.00	00.00	22.73 ± 2.51^{b}	31.93 ± 0.43^{bc}
Dennettia tripetala 2000 mg/mL	18.33 ±1.58^{b}	5.77 ±0.35^{b}	5.90 ± 0.66^{c}	22200.00 ±6588.62^{a}	23.37 ±8.27 ^{a}	68.63 ±7.76^{a}	8.00 ± 1.00^{ab}	00.00	00.00	21.07 ± 0.75^{ab}	31.47 ± 0.50^{bc}
Dennettia tripetala 4000 mg/mL	16.00 ±2.00^{b}	4.97 ±0.67^{a}	4.73 ± 1.16^{bc}	24500.00 ±4303.49^{a}	23.40 ± 4.42^{a}	69.27 ±3.30^{a}	7.33 ±1.53^{ab}	00.00	00.00	20.93 ±1.56^{ab}	30.70 ±0.70^{b}
Albendazole	18.33 ±1.53.14^{b}	5.87 ±0.86^{b}	4.33 ±0.74^{b}	25100.00 ± 4215.45^{a}	26.33 ± 12.68^{a}	67.33 ±11.38^{a}	7.50 ±1.53^{a}	00.00	00.00	19.93 ± 0.67^{ab}	31.87 ± 1.16^{bc}
Untreated	11.67 ±1.53^{a}	3.70 ±0.72^{a}	2.60 ± 0.36^{a}	27200.00 ± 1931.32^{a}	13.53 ±7.14^{b}	63.60 ± 5.08^{a}	15.33 ±2.51^{c}	00.00	00.00	17.63 ± 0.67^{a}	22.43 ± 0.23^{a}

Columns with values bearing same superscript are not significantly different at p>0.05

Table 6: Biochemistry indices of infected goats treated with *Vernonia amygdalina* and *Dennettia tripetala*.

Treatment	Glucose (mg/dL)	Total Protein (g/dl)	Albumin (g/dl)	Urea (mg/dl)	Creatinine (mg/dl)	AST (u/L)	ALT (u/L)
Vernonia amygdalina 2000 mg/mL	37.67± 1.45^{b}	6.30± 0.25^{ab}	2.93± 1.73^{ab}	15.00± 1.22^{a}	1.73± 1.20^{b}	202.00± 27.06^{a}	23.67± 1.86^{b}
Vernonia amygdalina 4000 mg/mL	30.00± 1.16^{a}	5.43± 0.20^{a}	3.17± 1.45^{ab}	15.33±1.65^{b}	1.90± 0.58^{c}	385.67±5.20^{c}	35.00 ± 2.08^{c}
Dennettia tripetala 2000 mg/mL	45.67± 2.33^{c}	6.20± 0.25^{bc}	3.53± 1.16^{b}	17.00±0.28^{b}	0.83 ± 0.67^{a}	273.67± 8.35^{b}	15.33± 1.45^{a}
Dennettia tripetala 4000 mg/mL	42.33±0.88^{bc}	6.70± 0.15 ^{c}	3.63 ± 0.88^{b}	16.33±0.35^{b}	0.57±0.89^{a}	407.67± 32.04^{c}	25 .67 ± 0.88^{b}
Albendazole	43.33± 1.45^{c}	5.93± 0.07^{bc}	3.50± 1.15^{a}	16.00±0.19^{b}	0.73 ± 0.89^{a}	189.33± 3.38^{a}	23.67± 1.76^{b}
Untreated	29.67± 1.62^{a}	5.67± 0.18^{ab}	2.47± 0.65^{a}	10.67±1.69^{a}	2.07 ±0.89^{c}	467.67± 12.98^{d}	53.33± 2.60^{d}

Columns with values bearing same superscript are not significantly different at p>0.05

Table 7: Worm burden and Deparasitization rate

Treatment	Worm burden	Deparasitization (%)
Vernonia amygdalina (2000 mg/mL)	7.33 ± 0.58^{a}	71.81 (%)
Vernonia amygdalina (4000 mg/mL)	5.00 ± 1.00^{a}	83.31 (%)
Dennettia tripetala (2000 mg/mL)	5.33 ± 0.58^{ab}	79.50 (%)
Dennettia tripetala (4000 mg/mL)	3.67 ± 0.58^{a}	85.89 (%)
Albendazole	4.33 ± 1.53^{a}	83.35 (%)
Untreated	26.00 ± 2.00^{c}	

Columns with values bearing same superscript are not significantly different at p>0.05

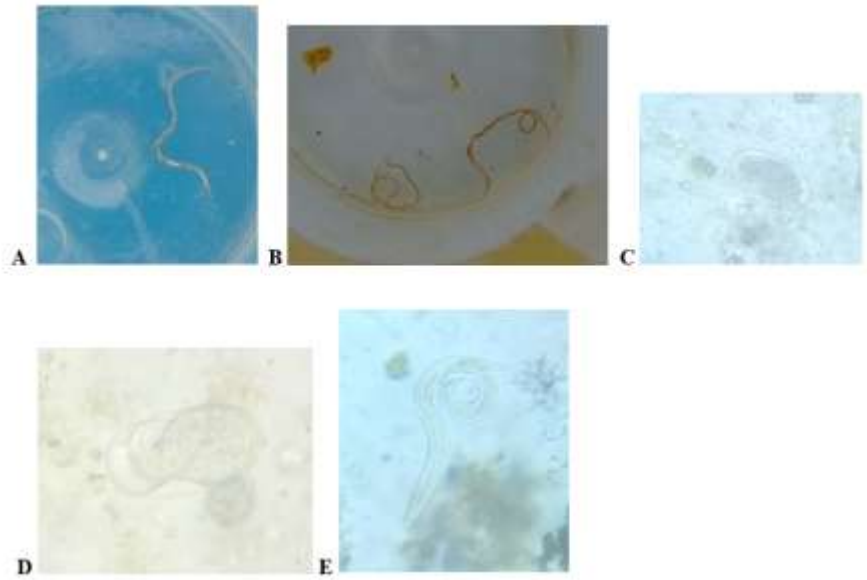


Figure 1: A: Female adult worm of *H. contortus* with blood stripes B: Male and Female adult worm of *H. contortus*. C: Egg of *H. contortus*, ×40 D: Embryonated egg of *H. contortus* ×40 E: Larvae of *H .contortus* ×40.

tripetala reduced when compared with the untreated group. . The MCV and MCHC level in animals treated with extracts of *V. amygdalina* and *D. tripetala* showed significant increase ($p<0.05$) when compared with the untreated. The highest level of MCV was recorded in *D. tripetala* administered at 2,000 mg/mL, while the lowest was recorded in *D. tripetala* at 4,000 mg/mL among the treated group. The highest MCHC was recorded in *V. amygdalina* administered at 2,000 mg/mL, while the lowest was recorded in *D. tripetala* administered at 4,000 mg/mL among the extract treated groups.

3.5 Biochemical Indices

The biochemical parameters of animals treated with *Vernonia amygdalina* and *Dennettia tripetala* extracts (Table 6) revealed that *V. amygdaline* and *D. tripetala* administered at 2,000 and 4,000 mg/mL showed a significant increase ($p<0.05$) in glucose level when compared to untreated animals. The highest glucose level was observed in animals treated with *D. tripetala* administered at 2,000 mg/mL, followed by *D. tripetala* administered at 4,000 mg/mL when compared to untreated group. The total protein level was higher in animals treated with *D. tripetala* than animals that received *V. amygdalina*. The least total protein was recorded in animals that received *V. amygdalina* at 4,000mg/mL. The albumin and urea levels in animals treated with extracts of *V. amygdalina* and *D. tripetala* showed a significant increase ($p<0.05$) when compared to the untreated. Albumin and urea levels were higher in *D. tripetala* than *V. amygdalina*. The highest urea level was recorded in *D. tripetala* at 2,000 mg/mL. There was a significant reduction ($p<0.05$) in the creatinine, AST and ALT levels in animals treated with extracts of *V. amygdalina* and *D. tripetala* when compared with the untreated. The lowest creatinine level was observed in 4,000 mg/mL of *D. tripetala*, followed by 2,000 mg/mL of *D. tripetala*. The highest AST level was recorded at 4,000mg/ml of *D. tripetala* while ALT level was lower in animals that received *D. tripetala* than in *V. amygdalina.*

3.6 Post Worm Count

The post worm count of worm burden in goats treated *V. amygdalina* and *D. tripetala* at different concentrations (Table 7) shows that at 35 days post infection, *D. tripetala* administered at 4,000 mg/mL has the highest deparasitization rate, while *V. amygdalina* at 2,000 mg/mL has the least deparasitization rate. There is significant difference ($p<0.05$) in the worm burden of treated groups and the untreated group.

Figure 1 revealed adult worm of male and female *H. contortus*, normal egg and larvae of *H. contortus*, anterior and posterior ends with ovum containing eggs of *H. contortus*.

4. Discussion

The acute toxicity study showed that the ethanolic extracts of *Vernonia amygdalina* and *Dennettia tripetala* were well tolerated when administered at doses of up to 3,000 mg/mL. However, *V. amygdalina* showed mild signs of emaciation in goats administered an oral dose of 5,000 mg/mL. No signs of morbidity or mortality were observed in any of the animals administered oral doses of either *V. amygdalina* or *D. tripetala*. This findings agrees with the report of Nwosu, (2021), who reported no signs of toxicity or mortality in albino rats administered an oral dose of 5,000 mg/kg of *D. tripetala,* Similarly, Zakari *et al.,* (2016), reported no signs of toxicity in rats administered oral dose of 5,000 mg/kg of *V. amygdalina*.

In this study, decrease in faecal egg count of infected animals treated with extracts of *V. amygdalina* and *D. tripetala*, compared with the untreated group shows both plants possess anthelmintic activity. This activity could be attributed to the presence of bioactive compounds in the plants. The anthelmintic activity of *D. tripetala* could be attributed to presence of saponins, tannins, alkaloids, steroid terpenoids and phenolic compounds in the plant. Studies have linked anthelmintic activity of some plants to the presence of saponins, tannins, phenols and alkaloids (Mapiye *et al.,* 2022; Nwosu *et al.,* 2021). The biological effects of these secondary metabolites have been shown to interfere with parasite homeostasis, causing paralysis that may eventually result in parasite death. Saponins and phenolic compounds have been reported to interfere with energy generation and disrupt the glycoproteins on the surface of parasites, ultimately leading to their death (Pratap *et al*., 2018).

The biological activities of saponins have been attributed to their interaction with cell membranes, resulting in increased cell permeability and membrane disruption. This interaction may induce the formation of micelle-like structures and cause cell lysis (Maestrini *et al.,* 2020). The biological activities of tannins have been attributed to their ability to disrupt phosphorylation processes in parasites, thereby causing parasite death. The binding of tannins to proteins on the cuticle may interfere with the supply of essential bioactive substances to parasite's cells, potentially resulting in parasite death (Soliman *et al*., 2024). Studies have also revealed that alkaloids exert biochemical and phytochemical effects on the mucopolysaccharide membranes of worms, exposing their outer layers to chemical attacks and ultimately causing their death (Pratap *et al*., 2018; Nwosu *et al.,* 2021).

The animals treated with *D. tripetala* extracts at 4,000 mg/mL recorded the lowest faecal egg count. This implies that *D. tripetala* extract possesses greater anthelmintic activity against helminths than *V. amygdalina* having higher egg per gram count. Hence, *D. tripetala* may serve as a potential alternative source of anthelmintic agents when administered at an appropriate dose. This activity could be associated with the presence of phytochemicals, including tannins, alkaloids, steroids, terpenoid, and phenolic compounds. This finding with the findings of Nwosu *et al*., (2022) who reported high mortality rates in *in vitro* examination of *D. tripetala* against *H. contortus.*

The faecal egg count of goats treated with *V. amydalina* was higher at doses of 2,000 and 4,000 mg/mL than that of goats treated with *D. tripetala*. This suggests that *V. amygdalina* had lower anthelmintic activity against *H. contortus* in the infected goats. This could be due to lower concentration or availability of certain bioactive compounds, such as tannins, alkaloids and steroids in the extract. This result agrees with the findings of Elysee *et al.,* (2025), who reported lower anthelminthic potency of *V. amygdalina* as a vermicidal agent.

The study also revealed the chemossupressive activities of *V. amygdalina* and *D. tripetala* against *H. contortus*. On day 25 post-infection, *V. amygdalina* administered at 4,000 mg/mL showed higher chemosuppression than *D. tripetala* administered at the same dose. This could be due to differences in the absorption and metabolism of the extracts in the animals. The higher chemosuppression observed with *D. tripetala* on the other days of the experiments may be attributed to the presence of alkaloids, tannins, saponins and phenolic compounds. This agrees with the *in vitro* study by Nwosu *et al.,* (2021), who reported high anthelmintic potency of *D. tripetala* against *H. contortus*. The *D. tripetala* extracts administered at 4,000 mg/mL had the highest chemo suppression rate, followed by *D. tripetala* administered at 2,000 mg/mL, whereas *V. amygdalina* administered at 2,000 mg/mL had the lowest chemo suppression compared with the positive control throughout the treatment period. According to W.A.A.V.P, faecal egg count reduction of 90% or above indicates the effectiveness of plant extracts against helminths and reflects a high level of anthelmintic activity (Burden *et al*., 2024). Therefore, *D. tripetala* at 2,000 mg/mL and 4,000 mg/mL demonstrated effective anthelmintic activity on day 35 post-infection.

The results of the chemosuppression activity of *V. amygadalina* and *D. tripetala* against *H. contortus* when administered on alternate days showed that *D. tripetala* had the highest chemo suppressive activity against the helminths. This may be due to the presence of compounds such as tannins, alkaloids and steroids responsible for disrupting parasite metabolism, impair nutrient absorption, motility and damage cell membranes (Yusuf *et al*., 2015). This findings is also consistent with the report of Nwosu *et al*., (2022), who recorded a high mortality rate in an *in vitro* examination of *D. tripetala* against *H. contortus.*

The study also revealed lower chemo suppression activity of *V. amygdalina* against helminths. This result agrees with the findings of Nalule *et al.,* (2011), who reported lower inhibition rates for *Vernonia*

amygdalina against helminths compared with *Phytolacca dodecandra* and albendazole after 21 days post infection. Similarly, Alawa *et al.,* (2003), reported lower efficacy of *V. amygdalina* against *H. contortus* when compared with the egg hatching inhibition rate of *Annona senegalensis*.

The study showed a significant increase in the PCV of animals that received *V. amygdalina* and *D. tripetala.* These findings agrees with the report of Flay *et al.,* (2022), who reported anaemia among sheep infected with *H. contortus*. The result also agrees with Xiang *et al*., (2022) who reported lower (PCV) values among lambs infected with *H. contortus* and fed with dairy meal.

The haemoglobin (Hb) and red blood cell (RBC) counts of infected animals treated with extracts of *V. amygdalina* and *D. tripetala* increased compared with those of the untreated groups. This finding correlates with the report of Malede *et al*., (2025), who reported alterations in Hb levels in sheep infected with *H. contortus*. It also aligns with report of Bandhaiya (2020), who observed a reduction in the red blood cells counts in infected goats. Furthermore, white blood cell (WBC) counts of both the treated and untreated animals showed no significant difference. The eosinophil values of infected animals treated with the plant extracts were lower than those of the untreated animals. The increase in WBC count in the untreated animals may be associated with the high worm burden and the resulting immune response to parasitic infection. The higher eosinophil counts in untreated animals may be associated with the role of eosinophils in combating parasitic infestations and modulating histamine-mediated inflammatory and immune responses during parasitic infections. This agrees with the report of Malede *et al*., (2025), who reported eosinophilia in sheep infected with *H. contortus* compared with uninfected sheep.

The MCV and MCHC values in the untreated group showed significant reductions compared with those of the extract-treated groups. This correlates with the findings of Jimenez-Penago *et al*., (2021), who reported decrease in MCV and MCHC parameters in sheep infected with *H. contortus* compared to uninfected sheep.

The highest MCV and MCHC was recorded in animals treated with *V. amygdalina* at 2,000 mg/mL, whereas the lowest was recorded in animals treated with *D. tripetala* at 4,000 mg/mL. This report agrees with the findings of Chike *et al.,* (2018), who reported an increase in MCV and MCHC among rats treated with *V. amygdalina*.

The serum biochemical analysis of goats treated with extracts of *V. amygdalina*, and *D. tripetala* showed variations in the biochemical parameters. The study revealed that the glucose level increased in animals that received *V. amygdalina* and *D. tripetala* at different concentrations compared with the untreated animals. This might be due to the effects of the administered extracts. The high glucose level observed in animals treated with *D. tripetala* may be related to its high carbohydrates content. This agrees with the report of Adebiyi *et al*., (2020), who reported a high percentage of carbohydrate and protein in *D. tripetala.* It also correlates with the findings of Muhammed *et al.,* (2021), who reported a high carbohydrate content in *D. tripetala* fruits.

The total protein level was higher in animals treated with *D. tripetala* than in those treated with *V. amygdalina*. This may be attributed to the high protein content of *D. tripetala* fruits and the ability of protein compounds to facilitate the rapid repair of worn out tissues. This finding correlates with the findings of Adebiyi *et al.,* (2020), who reported a high amount of protein in *D. tripetala* fruits. Among the extract treated animals, those administered *D. tripetala* at 4,000 mg/mL showed a significant increase in protein levels compared with the untreated group. Awad *et al.,* (2016) reported that, in parasitic gastroenteritis, excessive leakage of serum proteins occurs in heavily parasitized abomasal and intestinal tissues as a result of mucosal damage and perforation, resulting in decreased total protein levels in severely infected ruminants.

The lowest total protein level was recorded in animals that received *V. amygdalina* at 4,000 mg/mL. This might be due to the enzymatic activities of *V. amygdalina* in the animals. This finding agrees with the findings of Eraga *et al*., (2025), who reported the protein degrading activities of *V. amygdalina*, which may result in lower protein levels in animals administered higher doses of the plant extract. This finding also agrees with the report of Tokofai *et al.*, (2021), who reported a significant decrease in protein levels in birds treated with *V. amygdalina,* and with the findings of Olosunde *et al*., (2020), who reported a reduction in protein levels in West African goats administered *V. amygdalina.*

The albumin level of animals treated with *Vernonia amygdalina* administered at 2,000 mg/mL showed a significant reduction, whereas a significant increase in albumin level was observed in animals treated with *D. tripetala* administered at 4,000 mg/mL compared with the untreated group. The increase in albumin level in animals treated with *D. tripetala* may be associated with the presence of crude protein and high carbohydrate content in *D. tripetala* fruits, as reported by Muhammed *et al.,* (2021).

The urea level of animals treated with extracts of *Vernonia amygdalina* and *Dennettia tripetala* showed significant increase when compared with the untreated group. This may be due to the ability of the plant extracts to enhance kidney function and reduce protein broken-down thereby reducing the rate of tissue damage. Animals administered with *D. trepetala* at 2,000 mg/mL had the highest urea level. This finding is

in accordance with the report of Omage *et al.,* (2021), who reported that *Dennettia tripetala* possesses antioxidant properties and may have protective effects against glomerular damage. The report also corresponds with the findings of Akpakpann, *et al*., (2017), who reported an increase in urea levels in mice administered *D. tripetala*. However, *V. amygdalina* administered at 2,000 mg/mL produced the lowest urea level among the infected animals treated with the extracts. This may be due to protein loss during haemolysis caused by *H. contortus* in animals with a heavy worm burden.

Creatinine levels in animals treated with *V. amygdalina* and *D. tripetala* showed significant decrease when compared with the untreated. The plant extracts administered may have assisted the kidneys, reversing tissue impairment and improving renal clearance. The higher creatinine level observed in animals treated with 4,000 mg/mL of *V. amygdalina* compared with those treated with 4000mg/mL of *D. tripetala* may be associated with the metabolic activities of the plant extracts on the kidneys, their effects on the kidneys and their effects on nephron filtering the metabolic waste products. This finding agrees with the report of Udoeyop *et al*., (2017), who reported an increase in creatinine levels in rats treated with *D. tripetala* compared with the control group.

The aspartate transaminase (AST) levels in animals treated with *V. amygdalina* and *D. tripetala* at different concentrations of the plant extracts are significantly differed to those of the animals. The highest AST level was recorded in animals treated with 4,000 mg/mL of *D. tripetala* and this increase may be attributed to the high protein content of the fruit, which may assist in the replacement of proteins lost as a result of *H. contortus*. This finding correlates with the report of Muhammed *et al,* (2021), who reported a high crude protein content in *D. tripetala*. The ALT level was lower in animals that received *D. tripetala* than in those treated with *V. amygdalina*. This agrees with the report of Udoeyop *et al*., (2017), who reported less concentrations of ALT and AST in rats administered oral doses of *D. tripetala* compared with the control group.

The increase in ALT levels among the untreated animals may be attributed to tissue damage caused by *H. contortus.* This finding does not correlates with the report of Bandhaiya *et al.,* (2019), who reported significant increase in AST and ALT levels in untreated goats infected with *H. contortus* compared with goats treated with plant extracts. However, the present findings agrees with the report of Malede *et al.,* (2025), who reported hypoproteinemia and hypoalbuminemia in sheep infected with haemonchosis and treated with plant extracts.

5. Conclusion

H. contortus is a challenging parasite that infects ruminant animals, particularly sheep and goats. Its ability to feed on blood makes it one of the most pathogenic parasites affecting these animals. The study revealed that *V. amygdalina* and *D. tripetala* possess anthelmintic potential, which may be attributed to the presence of bioactive compounds in the plants. The study further revealed that *D. tripetala* exhibited higher anthelmintic potentials against *H. contortus* having the least egg per gram count and highest chemossuppression compared with *V. amygdalina* which had a higher faecal egg count and lower chemo suppressive activity The result showed alterations in the packed blood cell, haemoglobin, and red blood cell levels of the infected goats, which may be attributed to the haematophagous activity of *H. contortus.* The result also revealed alterations in glucose, total protein, albumin, urea, creatinine, ALT and AST levels in untreated goats infected with *H. contortus,* whereas these parameters were better maintained in animals treated with extracts of *V. amygdalina* and *D. tripetala*. The study further revealed that *D. tripetala* reduced worm burden more effectively than *V. amygdalina*, and the toxicity study showed that both plants were well tolerated when administered at an appropriate dose. The incorporation of *D. tripetala* and *V. amygdalina* into animal feed may reduce worm burdens in reared animals, incorporating the plants into pharmaceutical preparations may contribute to the control of parasitic helminth infections among individuals and communities.

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