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Research Article

EFFECTS OF CHICORY *(CICHORIUM INTYBUS)* AND *ARTEMISIA ABSENTHIUM* EXTRACTS AGAINST OVINE GASTROINTESTINAL NEMATODES

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ABSTRACT
This study was conducted to determine the efficacy of 2 medicinal plants (chicory (*Cichorium intybus*) and *Artemisia absenthium*) against ovine gastrointestinal nematodes in naturally infected sheep in Gharbia Governorate, Egypt. In vivo and in vitro studies revealed high effects of chicory *(Cichorium intybus)* and *Artemisia absenthium* extracts against ovine gastrointestinal nematodes. So, we recommend the use of these remedies by the farmers.

Keywords: *Sheep, Gastrointestinal Nematode, Chicory, Artemisia Absenthium, Treatment, Egypt*

INTRODUCTION
Gastrointestinal nematode (GIN) parasitism is arguably the most serious constraint affecting sheep production worldwide. Economic losses are caused by decreased production, costs of prophylaxis and treatment, and deaths of the infected animals (Miller and Horohov, 2006).
Failure of modern broad spectrum anthelmintics to control nematode parasites of sheep and goats is a reality of rapidly increasing dimensions on many farms in the tropical/subtropical regions of the world. This is primarily associated with the highly pathogenic, blood sucking parasite *Haemonchus contortus* where, annual mortalities exceeding 20% of the flock can be expected (Waller *et al.*, 2004).
The increasing prevalence of anthelmintic resistant strains of helminthes, drug residues in animal products and high cost of conventional anthelmintics has created an interest in the study of medicinal plants as alternative source of anthelmintics (Tariq *et al.*, 2009).
In recent years, there have been increasing interests in ethno-medical and ethno-veterinary practices across the world especially as it relates to the use of medicinal plants in treating various ailments. In developed world, this move is in response to the production of animals free from industrial chemical inputs (Gasbarre *et al.*, 2001) and the need to discover new therapeutic substances of natural origin with possibly low toxicity to man and animals (Guarrera, 1999).
There is a great interest in the development of non-chemical approaches to control helminths and insect pests of livestock in the last few years. Biological control will be an important part of livestock parasite control in the future (Padilha, 1999).
Few studies were carried out about possibility of some forage species to reduce production loss associated with internal parasitism (Niezen *et al.*, 1995). Previous in-vivo and in-vitro studies suggested that tanniferous plants can have direct anti-parasitic effect against different stages of nematodes (Bahuaud *et al.*, 2006).
The herb chicory (*Cichorium intybus*) and the condensed tannin-containing legumes have the potential to reduce the nematode burden in sheep and other species (Hoskin *et al.*, 1999), and/or associated with an improved growth rates in lambs which have high fecal parasite egg counts (Niezen *et al.*, 1998).
Artemisia absinthium is commonly called wormwood. It is used in indigenous systems of medicine as a vermifuge (Tariq *et al.*, 2009). Chemical analysis of *A. absinthium* has shown that its volatile oil is rich in thujone (α and β), which has been earlier reported as an anthelmintic (Meschler and Howlett, 1999).

To the authors' knowledge, there is no literature about the use of chicory (*Cichorium intybus*) and *Artemisia absinthium* in the treatment of gastrointestinal nematodes in Egypt. So, the aim of the present study was directed to assess in vivo and in vitro effects of aqueous extract of chicory and alcoholic extract of *Artemisia absinthium* in the treatment of ovine GIN

MATERIALS AND METHODS

Animals

Twenty lambs (about 8 months of age) naturally infected with gastrointestinal nematodes were used to determine the efficacy of 2 medicinal plants (chicory (*Cichorium intybus*)and *Artemisia absenthium*) against ovine gastrointestinal nematodes in Gharbia Governorate, Egypt" during the period from January 2008 to Jun 2010. The past history emphasize that all animals had not administered any anthelmentic during the last 3 – 6 months.

Hematological Examination and Blood Serum Total Proteins, Albumin and Globulin Determination

Paired blood samples were collected from experimental animals at 0 day and after one month of the experiment; one with anti coagulant to be used for hematological examination according to Coles (1989) and the other without to be used for serum separation for measuring blood serum total proteins, albumin and globulin levels using commercial kits.

Fecal Examination

Fecal samples were examined macroscopically and microscopically using concentration floatation technique and the positive samples were subjected to fecal egg count and fecal culture and larval identification according to Soulsby (1982).

Preparation of Chicory (Cichorium Intybus) Extract

One kilogram of the plant, in its herbal form, was extracted in water, filtered through filter paper in vacuum flask apparatus, and then dried in freeze drier. The dried extract was stored at – 4^{o}C until use (Alawa *et al.*, 2003).

Preparation of Artemisia Absinthium Extract

Alcoholic extracts from *Artemisia absinthium* were prepared according to Tariq *et al.*, (2009) by placing 200 g of powdered plant material in a conical glass percolator to which 1000 ml of 95% methanol was added. Plant material was allowed to macerate for 16 hours at room temperature and the percolate was collected by filtering through cotton wool (non-absorbent). The process of maceration/percolation was repeated three times (1000 ml). The combined filtrate was completely evaporated in a vacuum rotary evaporator under reduced pressure at 50^{o}C to obtain crude methanolic extract. The extract was scraped off and transferred to a container and kept air tight; it was stored at 4^{o}C until further use.

Determination the Effects of Chicory (Cichorium Intybus) and Artemisia Absinthium Extracts in Reducing GIN Eggs Output

Twenty native yearling, naturally infested with GIN were identified by fecal culture divided into 4 groups (each of 5).; the first group was treated with crude alcoholic *Artemisia absinthium* extract (2gm/Kg B.W. per OS) (Tariq *et al.*, 2009), the second group was treated with crude aqueous *Cichorium intybus* extract (3gm/KgBw per OS) (Barry, 1998 and Cenci *et al.*, 2007), the third group was treated with ivermectin (0.2mg/Kg Bw S.C.) and the last group was kept untreated. These lambs fed on dry ration during the experiment period. Fecal egg counts were determined using Mc-Master techniques at day 0, 5, 10, 15, 20, 25 and 30 post treatments. Fecal culture and hematological examinations were carried out before and 30 days after treatment. The reduction of nematode egg counts including *Haemonchus contortus* fecal eggs was determined using Mc-Master techniques at day 0, 5, 10, 15 and 30 after treating. In addition hematological examination was carried out before and after treatment.

Fecal Hatch Assay for Determination the Effects of Chicory and Artemisia Absinthium Extracts on GIN Eggs

It was done according to Alawa *et al.*, (2003). Briefly, fresh feces were collected from naturally infected sheep, and then thoroughly mixed. Eggs were counted using Mc-Master method**.** Fecal matter was weighted and divided in 6 containers (for each extract) with different concentration of chicory or

Artemisia absinthium extracts as following : - The 1st : 5 gm feces and 5 gm saw dust, The 2nd contained 5 gm feces, 4.9 gm saw dust and 0.1 gm dry extract, The 3rd contained 5 gm feces, 4.8 gm saw dust and 0.2 gm dry extract, The 4th contained 5 gm feces, 4.6 gm saw dust and 0.4 gm dry extract, The 5th contained 5 gm feces, 4.4 gm saw dust and 0.6 gm dry extract, The 6th contained 5 gm feces, 4.2 gm saw dust and 0.8 gm dry extract. These mixtures were loosely packed into the bottom of the containers (about ¼ of volume) capped loosely and allowed to stand at room temperature for 8 days. Larvae were harvested with Baermann technique. The obtained larvae were counted and their viability concerning its movement under microscope was recorded. In addition, the remained un-hatched eggs were counted using Mc-Master method**.**

In vitro Determination the Effects of Chicory (Cichorium Intybus) and Artemisia Absinthium Extracts against Adult Haemonchus Contortus

Mature *Haemonchus contortus* worms were collected from the abomasa of freshly slaughtered sheep, washed, suspended in phosphate buffered saline (PBS) and transported to the laboratory. The chicory and *Artemisia absinthium* extracts were diluted in PBS and in 0.5% dimethylsulphoxide (DMSO) respectively and tested at 12.5, 25 and 50mg ml^{-1}. Albendazole, a well known anthelmintic dissolved in DMSO (0.5%) at concentration of 0.55 mg $ml^{-1}$and used as reference drug (positive control). DMSO (0.5%) and distilled water were the negative control. Ten worms were exposed to each treatment at controlled temperature (37 ± 1°C). Three replicates were performed for each treatment. Inhibition of worm motility was the rationale for anthelmintic activity. The time required for paralysis or complete inactivity and mortality was recorded at 0, 1, 2, 4, 6 and 8 h intervals. After 8 hours the extracts and albendazole were washed away and parasites re-suspended in lukewarm PBS for 30 minutes to test the revival of the worm motility and calculate the mortality index was calculated according to Tariq *et al.,* (2009).

In vitro Determination the Effects of Albendazole, Levamisole and Ivermectin against Adult Haemonchus Contortus

Mature *Haemonchus contortus* worms were collected from the abomasa of freshly slaughtered sheep. These worms were washed, suspended in phosphate buffered saline (PBS) and transported to the laboratory. The drugs were diluted in 0.5% dimethylsulphoxide (DMSO) and tested at 0.55mg ml^{-1} and 1mg ml^{-1} DMSO (0.5%) was the negative control. Ten worms were exposed to each treatment at controlled temperature (37 ± 1°C). Three replicates were performed for each treatment. Inhibition of worm motility was the rationale for anthelmintic activity. The time required for paralysis or complete inactivity and mortality was recorded at 0, 1, 2, 4 and 6 h intervals then the mortality index was calculated according to Tariq *et al.,* (2009).

Statistical Analysis:

Statistical analysis was carried out by using statistical soft ware program (GMP for windows version 5.1, SAS Institute, Cary, NC, USA). Differences between means at $P < 0.05$ were considered significant.

RESULTS

Determination of Chicory and Artemisia Absinthium Efficacy in Reducing GIN Eggs Output

Concerning the nematode species which obtained from fecal culture before treatment it was identified as *Haemonchus, Trichostrongylus species, Trichostrongylus axei, Strongyloides* and *Bunstomum* in a percent of 50, 20, 10, 10 and 10% respectively.

Concerning the reduction of nematode fecal egg counts including *Haemonchus contortus* fecal eggs, the nematode egg count per gram in group (G1) treated with alcoholic crud extract of *Artemisia absenthium* (2gm/kg Bw) was 1133.33±266.66 EPG on 0 day and 583.33±192.2 EPG after 5 day then negative till the end of experiment, in group (G2) treated with aqueous crud extract of chicory (3gm/kg Bw) was 800±230.94 EPG on 0 day and 400±217.94 EPG after 5 day then negative till the end of experiment, in group (G3) group treated with Ivermectin (200µg/kg Bw) was 3266.67±2967.22 EPG on day 0 and negative from day 5 till the end of experiment and in group (G4) untreated group was 666.66±240.37, 700±378, 1000±529.15, 933.33±5.3.32, 1400±757.18, 866.66±290.56 and 933.33±240.37 EPG on day 0, 5, 10, 15, 20, 25 and 30 respectively at the end of experiment (Table 1).

Concerning hematological changes in infected sheep before and after treatment with chicory and *Artemisia absenthium* extracts, the results were illustrated in table 2.

Concerning the serum biochemical changes in infected sheep before and after treatment with chicory and *Artemisia absenthium* extracts were illustrated in table 3.

Fecal Hatch Assay for Determination the Effects of Chicory and Artemisia Absinthium Extracts against Nematode Eggs

The results of the efficacy of chicory and Artemisia extract against nematode egg hatchability *in vitro,* the identified third stage larvae from control fecal culture were *Haemonchus, Trichostrongylus* species, *Trichostrongylus axei* and *Bunstomum,* the identified third stage larvae from 1% chicory extract concentration of fecal culture were *Haemonchus, Trichostrongylus* species and *Bunstomum,* the identified third stage larvae from 2% chicory extract concentration of fecal culture were *Haemonchus, Trichostrongylus* species and *Bunstomum,* the identified third stage larvae from 4% chicory extract concentration of fecal culture were *Haemonchus, Trichostrongylus* species, *Trichostrongylus axei* and *Bunstomum,* the identified third stage larvae from 1% Artemisia extract concentration of fecal culture were *Haemonchus* and *Bunstomum,* the identified third stage larvae from 2% *Artemisia* extract concentration of fecal culture were *Haemonchus* and *Trichostrongylus axei* (Table 4)

The results of the efficacy of chicory and *Artemisia absinthium* extracts against egg hatching, total number of obtained larvae from fecal culture contain different concentration of extract was 6.08, 4.5, 0.83, 3.3, 0.3, 0.46, 0.38, 0.3 and 0.23 larvae/ml in control sample, 1%, 2%, 4%, 6% and 8% chicory concentration, 1%, 2% and 6% *Artemisia* concentration respectively include viable with percent of 93.75, 90, 27.71, 0.09, 50% for control sample, 1%, 2%, 4% and 8% chicory concentration respectively, moderate viable larvae with percent 40.9 and 50% for 4% and 8% chicory concentration respectively, inactive larvae with percent 3.78, 3.3, 36.14, 27.27, 50, 39.47 and 100% for control, 1%, 2%, 4% and 6% chicory concentration, 1% and 2% *Artemisia* concentration respectively, dead larvae with percent 2.47, 6.66, 36.14, 22.72, 50, 60.53 and 100% for control sample, 1%, 2%, 4% and 6% chicory concentration, 1% and 6% *Artemisia* concentration respectively (Table 5)

The egg recovered after fecal culture was developed and viable egg with percent 4.8% for control sample, developed egg but in-viable with percent 4.8, 9.75, 4.8, 4.8 and 9.75% for control sample, 2% and 8% chicory concentration, 6% and 8% *Artemisia* concentration respectively, undeveloped egg with percent 14.6, 9.75, 4.8, 34.14, 92.68, 63.41, 58.53, 48.78, 19.51, 4.8 and 4.8% for control sample, 1%, 2%, 4%, 6% and 8% chicory concentration 1%, 2%, 4%, 6% and 8% *Artemisia* concentration respectively (Table 6).

In vitro Determination the Effects of Chicory (Cichorium Intybus) and Artemisia Absinthium Extracts against Adult Haemonchus Contortus

Concerning the efficacy of extracts from chicory (*Cichorium intybus*) and *Artemisia absinthium* against adult *Haemonchus contortus* in vitro, the percent of viable adult worm was 100% in all plate at the beginning of experiment, 100, 100, 70, 90, 80, 60, 90, 70 and 0% after 2 hours, 90, 100, 40, 80, 60, 0, 60, 0 and 0% after 4 hours, 80, 80, 70, 60, 10, 0, 40, 0 and 0% after 6 hours, 80, 80, 40, 40, 0, 0, 10, 0 and 0% after 8 hours, 100, 100, 70, 50, 0, 0, 60, 0 and 0% after put in PBS for 30 minutes, the mortality index for each plate were 0, 0, 0.3, 0.5, 1, 1, 0.4, 1 and 1 for control with PBS, control with DMSO, control with albendazole (0.55mg/ml), 12.5mg/ml, 25mg/ml, 50mg/ml chicory concentration, 12.5mg/ml, 25mg/ml and 50mg/ml *Artemisia* concentration respectively (Table 7).

In vitro Determination the Susceptability of Adult Haemonchus Contortus to Albendazole, Levamisole and Ivermectin

The results of in vitro susceptibility of adult *Haemonchus contortus* to albendazole, levamisole and ivermectin revealed that the percents of viable adult worms were 100% in all plate at the beginning of experiment, 100, 70, 100, 100, 40, 40 and 40% after 2 hours, 100, 70, 80, 40, 40, 40 and 0% after 4 hours, 100, 70, 80, 30, 40, 40 and 0% after 6 hours for control with DMSO, 0.55mg/ml, 1mg/ml albendazole, 0.55mg/ml, 1mg/ml levamizole, 0.55mg/ml and 1mg/ml ivermectin (Table 8).

Table 1: Effects of chicory and Artemisia in the reduction of fecal egg counts

Group	Egg count / gm feces						
	0 day	After 5 day	After 10 day	After 15 day	After 20 day	After 25 day	After 30 day
G1 (treated with Artemisia)	1133.33±266.66	583.33±192.2	-ve	-ve	-ve	-ve	-ve
G2 (treated with chicory)	800±230.94	400±217.94	-ve	-ve	-ve	-ve	-ve
G3 (control treated with Ivermectin)	3266.66±2967.22	-ve	-ve	-ve	-ve	-ve	-ve
G4 (control untreated)	666.66±240.37	700±378	1000±529.15	933.33±503.32	1400±757.18	866.66±290.56	933.33±240.37

Table 2: Hematological changes in sheep infected with gastrointestinal nematodes before and after treatment with chicory (*Cichorium intybus*) and *Artemisia absinthium* extracts

Group	RBCs (mil/cmm)		Hb (gm/dl)		PCV (%)		MCV		MCH		MCHC	
	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment
G1 (treated with Artemisia)	4.2±0.06	6.2±0.34*	8.6±0.4	12.06±0.43*	28.1±1.19	34.4±0.41*	65.82±2.2	55.81±3.08	20.13±0.61	19.53±0.88	30.63±1.03	35.1±1.59
G2 (treated with chicory)	4.4±0.06	5.1±0.05*	9.7±0.05	10.46±0.35	31.23±0.91	32.4±0.7	69.94±2.12	63.51±0.89*	21.72±0.34	20.51±0.46	31.09±0.74	32.28±0.52
G3 (control treated with Ivermectin)	3.9±0.28	5.5±0.35*	7.2±1.2	11.2±0.8	22.36±3.8	32.86±0.46	56.57±6.9	60.13±2.9	18.2±2.09	20.4±0.5	32.39±0.46	34.11±2.1
G4 (control untreated)	4.6±0.1	4.2±0.06	9.5±0.08	8.8±0.5	30.6±0.5	28.66±2	66.58±1.6	67.07±3.7	20.7±0.4	20.5±0.8	31.16±0.24	30.75±0.52

** Significant at P ≤0.05*

Table 3: Serum biochemical levels in sheep infected with gastrointestinal nematodes before and after treatment with chicory (*Cichorium intybus*) and *Artemisia absinthium* extracts

Group	Serum total protein (g/100ml)		Serum albumin (g/100ml)		Serum globulin (g/100ml)		Albumin globulin ratio (A/G ratio) (%)	
	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment	Before treatment	After 30 days of treatment
G1 (treated with Artemisia)	9.23±0.17	10.43±0.24*	3.23±0.03	3.83±0.06*	6±0.2	6.6±0.3	0.54±0.02	0.7±0.21*
G2 (treated with chicory)	8.43±0.91	10.8±0.46	3.02±0.21	3.8±0.1*	5.4±0.7	7±0.49	0.56±0.04	0.61±0.22*
G3 (control treated with Ivermectin)	7.53±0.48	9.93±0.06*	2.6±0.19	3.6±0.11*	4.85±0.29	6.33±0.06*	0.55±0.01	0.77±0.11*
G4 (control untreated)	8.86±0.53	9.13±0.14	3.05±0.17	3.13±0.12	5.8±0.36	6±0.2	0.52±0.01	0.52±0.03

** Significant at P ≤0.05*

Table 4: Third stage larvae recovered from fecal culture assay

Extract	concentration	*Haemonchus*	*Trichostrongylus sp.*	*Trichostrongylus axei*	*Bunstomum*
Control		+	+	+	+
Chicory	0.1	+	+	---	+
	0.2	+	+	---	+
	0.4	+	+	+	+
Artemisia	0.1	+	---	---	+
	0.2	+	---	+	---

Table 5: Recovered larvae from fecal culture assay

Extract	concentration	lived larvae						Dead larvae (L/ml)		Total
		Viable (L/ml)		Moderate viability (L/ml)		Inactive larvae (L/ml)				
		No.	%	No.	%	No.	%	No.	%	
Control		5.7	93.75	---	----	0.23	3.78	0.15	2.47	6.08
	1%	4.05	90	---	---	0.15	3.3	0.3	6.66	4.5
	2%	0.23	27.71	---	---	0.3	36.14	0.3	36.14	0.83
Chicory	**4%**	0.3	0.09	1.35	40.9	0.9	27.27	0.75	22.72	3.3
	6%	---	---	---	---	0.15	50	0.15	50	0.3
	8%	0.23	50	0.23	50	---	---	---	---	0.46
	1%	---	---	---	---	0.15	39.47	0.23	60.53	0.38
	2%	---	---	---	---	0.3	100	---	---	0.3
Artemisia	**4%**	---	---	---	---	---	---	---	---	---
	6%	---	---	---	---	---	---	0.23	100	0.23
	8%	---	---	---	---	---	---	---	---	---

Table 6: Egg obtained from fecal culture assay

Extract	Concentration	EPG at 0 day	Developed egg				Undeveloped egg		Total obtained egg	
			Viable		in viable					
			No.	%	No.	%	No.	%	No.	%
Control		4100	200	4.8	200	4.8	600	14.6	800	19.51
	1%	4100	---	---	---	---	400	9.75	400	9.75
	2%	4100	---	---	400	9.75	200	4.8	600	14.6
Chicory	**4%**	4100	---	---	---	---	1400	34.14	1400	34.14
	6%	4100	---	---	---	---	3800	92.68	3800	92.68
	8%	4100	---	---	200	4.8	2600	63.41	2800	68.29
	1%	4100	---	---	---	---	2400	58.53	2400	58.53
	2%	4100	---	---	---	---	2000	48.78	2000	48.78
Artemisia	**4%**	4100	---	---	---	---	800	19.51	800	19.51
	6%	4100	---	---	200	4.8	200	4.8	400	9.75
	8%	4100	---	---	400	9.75	200	4.8	600	14.6

Table 7: In vitro effects of chicory (*Cichorium intybus*) and *Artemisia absinthium* extracts against adult *Haemonchus contortus*

extract	Concentration	Viable adult in each plate												Mortality index
		At 0 hour		After 2h		After 4h		After 6h		After 8h		After 30min in PBS		
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Control with PBS				10	100	9	90	8	80	8	80	10	100	0
Control with DMSO				10	100	10	100	8	80	8	80	10	100	0
Control with albendazole (0.55mg/ml)				7	70	4	40	7	70	4	40	7	70	0.3
	12.5mg/ml			9	90	8	80	6	60	4	40	5	50	0.5
Chicory	25mg/ml	10	100	8	80	6	60	1	10	---	0	---	0	1
	50mg/ml			6	60	---	0	---	0	---	0	---	0	1
	12.5mg/ml			9	90	6	60	4	40	1	10	6	60	0.4
Artemisia	25mg/ml			7	70	---	0	---	0	---	0	---	0	1
	50mg/ml			---	0	---	0	---	0	---	0	---	0	1

Table 8: In vitro susceptibility of adult *Haemonchus contortus* to albendazole, levamisole and ivermectin

Drug used	Concentration	Viable adult in each plate								Mortality index
		At 0h		After 2h		After 4h		After 6h		
		No.	%	No.	%	No.	%	No.	%	
Control with DMSO				10	100	10	100	10	100	0
Albendazole	**0.55 mg/ml**			7	70	7	70	7	70	0.3
	1 mg/ml			10	100	8	80	8	80	0.2
Levamisole	**0.55 mg/ml**	10	100	10	100	4	40	3	30	0.7
	1 mg/ml			4	40	4	40	4	40	0.6
Ivermectin	**0.55 mg/ml**			4	40	4	40	4	40	0.6
	1 mg/ml			4	40	---	0	---	0	1

DISCUSSION

Concerning the *in vivo* efficacy of chicory and *Artemisia absinthium* against gastrointestinal nematodes, the results revealed that chicory and *Artemisia* extracts were effective and reduced nematode eggs output in fifth day of experiment and stopped nematode eggs output on 10th day after treatment. In addition significant increase in RBCs, Hb and PCV levels in sheep groups treated with *Artemisia* and only significant increase in RBCs levels in groups treatment with chicory and ivermectin was recorded. Also significant increase in serum total protein levels in groups after treatment with *Artemisia* and significant increase in albumin in all groups after treatment. Similar results were reported by Al-Gaabary *et al.,* (2007); Athanasiadou *et al.,* (2007) and Kidane *et al.,* (2010) who found that infected animals that grazed on chicory had lower fecal egg counts and adult nematode burden. Tariq *et al.,* (2009) found significant anthelmintic effects of crude aqueous extracts (CAE) and crude ethanolic extracts (CEE) on live adult *Haemonchus contortus* worms (paralysis and/or death), however CEE were more effective than CAE. Moreover, oral administration of the extracts in sheep was associated with significant reduction in fecal egg out-put by the gastrointestinal nematodes. Our results were differed from that obtained by Marley *et al.,* (2003) who found that lambs that grazed chicory did not have significantly lower FEC than lambs grazing on other forages but its efficacy against the adult was proved where, these lambs were found to have fewer total adult abomasal helminthes. Squires *et al.,* (2011) also recorded non significant effects of *Artemisia absinthium* against *Haemonchus contortus* at dose 1000 mg/kg BW.

The decrease in fecal nematode eggs counts may be attributed to the effect of chicory extract which resulted in decrease of adult nematode burden. Marley *et al.,* (2003) and Tzamaloukas *et al.,* (2005) found that chicory affected adult worms and 4th larval stage. Also Molan *et al.,* (2000) found that condensed tannins and sesquiterpene lactones from chicory had direct effect on viability of lung worm larvae of deer. On the other hand, the effect of *Artemisia absinthium* may be attributed to its properties which include toxicity to nematodes (Sherif *et al.,* 1987) and also thujone (α and β) of *Artemisia absinthium* which had been reported as an anthelmintic (Meschler and Howlett, 1999).

In vitro efficacy of different concentration of chicory and *Artemisia absinthium* extracts on fecal hatch assay revealed that 6% chicory concentration resulted in lowest larvae obtained (0.3 larvae/ml) compared with control (6.08 larvae/ml) in addition 50% of larvae obtained were being in active and other 50% were dead while 4 and 8% *Artemisia* resulted in zero recovered larvae from fecal culture. In addition the percent of total egg counts after fecal culture compared to egg counts before fecal culture were higher in 6% chicory (92.68%) and all eggs present were undeveloped (contain embryonic cells) indicate that chicory extract suppress the development of nematode eggs at 6% concentration while *Artemisia* extract at concentration 1% and 2% the nematodes eggs present were 58.53% and 48.78% respectively. Our results were similar to that obtained by Molan *et al.,* (2000) and Schreurs *et al.,* (2002). These results may be attributed to the anthelmintic activity of chicory that contain condensed tannin 1.7g/Kg DM, sesquiterpene lactones 3.6g/Kg DM, cichoriin 0.5g/Kg Dm and chicoric acid 5.8g/Kg DM (Jackson *et al.,* 1996). Moreover, Niezen *et al.,* (1995) and Niezen *et al.,* (1998) found that the forage which contain condensed tannin have good effect on reducing gastrointestinal nematode. In addition, sesquiterpene lactones have a direct effect on nematode and viability of the first and the third larval stages. Moreover, the chemical analysis of *Artemisia absinthium* has shown that its volatile oil is rich in Thujone (α and β), which has been earlier reported as an anthelmintic (Meschler and Howlett, 1999).

The efficacy of different concentrations of chicory (*Cichorium intybus*) and *Artemisia absinthium* extracts against adult *Haemonchus contortus in vitro* revealed that chicory extract (50mg/ml) and Artemisia extract (25mg/ml) caused death of all adult worms after 4 hours while *Artemisia* extract (50mg/ml) was affect and causing death for all adult worms after 2 hours. Similar results were obtained by Marley *et al.,* (2003); Tzamaloukas *et al.,* (2005) and Athanasiadou *et al.,* (2007) who found that chicory affect on adult worms. In addition Tariq *et al.,* (2009) found that *Artemisia absinthium* extracts affected on adult *Haemonchus contortus* in concentration 25mg/ml.

These results may attributed to the chemical composition of chicory which contain condensed tannins and sesquiterpene lactons and Artemisia which contain Thujone (α and β) which have direct effect on adult

nematodes. In addition alcoholic extract of Artemisia was easier and rapid transcuticular absorption into the body of worms owing to the lipid soluble nature of the alcoholic extracts (Eguale *et al.*, 2007).

The results of *in vitro* susceptibility of adult *Haemonchus contortus* to albendazole, levamisole and ivermectin revealed that ivermectin caused death of all worms after 4 hours at concentration 1mg/ml while other drugs not completely affected the viability of adult *Haemonchus* in different concentrations. Similar results were obtained by Chandrawathani *et al.*, (1999) who found that levamisole was not effective against nematodes and Sissay *et al.*, (2006) who found that albendazole was not effective against nematodes. Our results differed from that recorded by Tariq *et al.*, (2009) who found that albendazole was highly effective on adult *Haemonchus* at 0.55 mg/ml concentration, Kamaraj *et al.*, (2011) who recorded that albendazole in concentration 0.075mg/ml and ivermectin in concentration 0.025 mg/ml were effective against *Haemonchus contortus* in vitro, Gill *et al.*, (1991) found that 50% inhibition of nematode motility was achieved with avermectin concentrations between 0.3 and 0.49 microM while 50% inhibition of nematode motility values of avermectin resistant isolates ranged from 0.8 to 2.6 microM. In addition Devaney and Howells (1984) found that the microfilariae were insensitive to ivermectin at concentrations to 30 ng/ml. while Kudo *et al.*, (2008) found that *Gongylonema pulchrum* larvae was effectively treated with high concentrations of levamisole (1 and 10 microg/ml). The lake of efficacy may be attributed to the resistance which may be developed as a result of improper usage of these drugs. Finally it can be concluded that, gastrointestinal nematode is more prevalent among examined sheep and chicory *(Cichorium intybus)* and *Artemisia absenthium* extracts are highly effective against ovine gastrointestinal nematode and we recommend the use of these remedies by the farmers.

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