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Annals of Biological Research, 2011, 2 (1) : 226-230
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0976-1233
CODEN (USA): ABRNBW

Effects of different levels of wattle tannin drenches on faecal egg counts during naturally acquired mixed nematode infections in Moghani sheep

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ABSTRACT

The main propose of this study was to investigate the effect of single dose administration of different levels of wattle tannin drenches on gastrointestinal nematodes faecal egg counts in Moghani sheep. Approximately 250 free grazing Moghani ewes were monitored for finding gastrointestinal nematode infected animals usigng Mc master technique and among them, 20 infected ewes (averaging 7-12 months by mean live body weight (LBW): 33±2 kg) were selected randomly and divided into 4 treatment groups. One of the groups was control group and received only tap water as placebo and the rest three groups were drenched single dose of 1, 1.5 and 2 gr WT/kg LBW respectively. Subsequently, faecal samples were taken 6, 12, 24 and 48 hours after drenching from each group and FECs were examined and recorded. Data were analyzed as a complete randomized design for repeated measurements using SAS (9.1). Results shown Treatment with 1.5 gr WT/kg body weight could cause significant reduction in FEC, from 24 hours after drenching so that its effect remained constant up to end of the study, whereas administration of 2 gr WT/kg body weight demonstrated its efficacy from 12 hours after drenching and reached to the maximum efficacy after 24 hours and then FEC levels remained constant up to the end ($P< 0.05$). Administration of 1 gr WT/kg LBW had no significant effect on FEC after 6, 12, 24 and 48 hours after drenching ($P> 0.05$).

***Key words**: Wattle tannin, Faecal egg counts, Gastrointestinal nematode, Sheep*

INTRODUCTION

Small ruminants make a significant contribution to food security and income of many resource-poor families in most developing countries. There are many constraints to small ruminant

production including a range of diseases, poor nutrition, internal and external parasites. However, the main constraint to production of small ruminants in the developing countries is gastrointestinal parasites, particularly nematodes. Parasitic infections lead to decreased productivity of affected animals which show poor growth rates, reduced reproductive performances, mortality, quality products and increased production costs [1]. Trichostrongyle infections are responsible for major economical losses in the sheep and goat industries due to either direct (host mortalities, decreases in production) or indirect (needs for treatments, labour costs, housing) consequences. For many years, anthelmintic (AH) drugs have represented the cornerstone of control for these parasitic diseases. However, since the first suspicion of resistance to phenothiazine, the phenomenon of AH resistance has shown a constant development. It has now reached a stage where the efficiency of this mode of chemical control is dramatically challenged [2]**.**

Apart from anthelmintic resistance, synthetic anthelmintics are expensive and for resource-poor farmers in developing countries including Iran, traditional herbal remedies based on local plants offer an alternative to the expensive and often inaccessible commercial anthelmintics. Several studies are now under-way to evaluate some of the 'best candidates' used as livestock de-worming preparations by resource-poor communities in East Africa or Asia [3]. The search for new alternative methods for worm management, which are less reliant on the use of anthelmintics and more sustainable, has therefore been recognized [1]. Also there is considerable and apparently expanding interest worldwide in traditional health practices in both the industrialized and developing countries of the world including herbal de-wormers. A role for these compounds in the green farming movement of developed countries is difficult to envisage because marketing of products with a high level of efficacy will inevitably be accompanied by regulatory requirements on residue levels, human safety, and so on, and will then, particularly in the organic farming context, become quasi-natural and regarded as medical prevention [3]. Several studies have shown that the consumption of tannin-rich plants is associated with an improvement of host resistance and/or resilience against the gastrointestinal nematodes (GIN). Significant reductions in egg excretion and/or worm burdens have been described in goats and sheep fed with tannin-rich plants/ plant products [4].

Tannins are usually classified either hydrolysable tannins (HT) or condensed tannins (CT) (proanthocyanidins) based on their molecular structure. Hydrolyzable tannin molecules contain a carbohydrate (generally D-glucose) as a central core. The hydroxyl groups of these carbohydrates are esterified with phenolic groups, such as ellagic acid or Gallic acid. Hydrolyzable tannins can be further metabolized to compounds such as pyrogallol, which are potentially toxic to ruminants. Some rumen bacteria involved in this degradative pathways. The CTs are the most common type of tannin found in forage legumes, trees, and shrubs. Structurally, CT is complexes of oligomers and polymers of flavanoid units linked by carbon-carbon bonds. The CT exist as oligomers of flavan-3-ols (catechin) or flavan-3,4-diols (epicatechin). Together, these differences can produce an infinite variety of chemical structures, which in turn affect the physical and biological properties of the CT. Condensed tannins accumulate in the vacuoles of cells in various tissues of many plants [5].

Field studies in temperate regions indicated positive results when nematode parasitized sheep were fed on forages rich in tannins. These findings were the impetus behind a number of studies investigating the effect of tannins on GIN parasitism in small ruminants. Incubation of adult nematodes in cultures containing varying loads of tannins from different plant species showed significant reductions in the survival of various adult nematodes. Animal trials in which sheep and goats in the tropics were drenched with solutions of a commercial tannin preparation, wattle

tannin (WT), gave significant reductions in both faecal egg counts (FEC) and worm burdens in sheep but only a slight effect in goats. It was argued that, tannins could have effects on other important parasitological parameters such as female worm fecundity or reduction in hatchability of worm egg in faeces passed out after WT administration [1]. The present study was therefore aimed at investigating the short term effects of different levels of WT by single dose drenches on faecal egg count (FEC) during a naturally acquired mixed GIN infection.

MATERIALS AND METHODS

This study was carried out at Moghan plateau –Northwest of Iran, which is located around 30°24'35.47" N and 48°18'12.36" E altitude at 98 m above sea level from July to September 2010.Approximately 250 free grazing Moghani ewes (without any anthelmentic therapy at the last 4 months) were monitored for finding GIN infected animals using faecal sample (Directly taken from the animals rectum) examination using Mc master technique [6] and among them, 20 infected ewes (averaging 7-12 months by mean live body weight (LBW): 33±2 kg) which had moderate load of mixed GIN infection (Mean Fecal egg count (FEC) =506) were selected and subsequently assigned randomly into 4 equal groups.

Wattle tannin powder (as a commercial Tannin) was bought from the Tanzania Wattle leather industry Co. Ltd. The WT powder is extracted from barks of black wattle tree (*Acacia mearnsii*) and is a complex mixture of phenolic compounds which contained approximately 625gr CT /kg DM.

One of the groups was control group and received only tap water as placebo and the rest three groups were drenched single dose of 1, 1.5 and 2 gr WT/kg LBW as A, B and C treatment groups respectively. Subsequently, faecal samples were taken 6, 12, 24 and 48 hours after WT drenching from each group and FECs were examined and recorded. The impact of treatment on faecal egg output was measured using FECs taken at mentioned times after drenching. Data were analyzed as a complete randomized design for repeated measurements using SAS (9.1) software [7] and the least square means compared with Tukey multiple range tests.

RESULTS AND DISCUSSION

Table 1- Effects of Wattle Tannin Single Dose Drenching on FEC

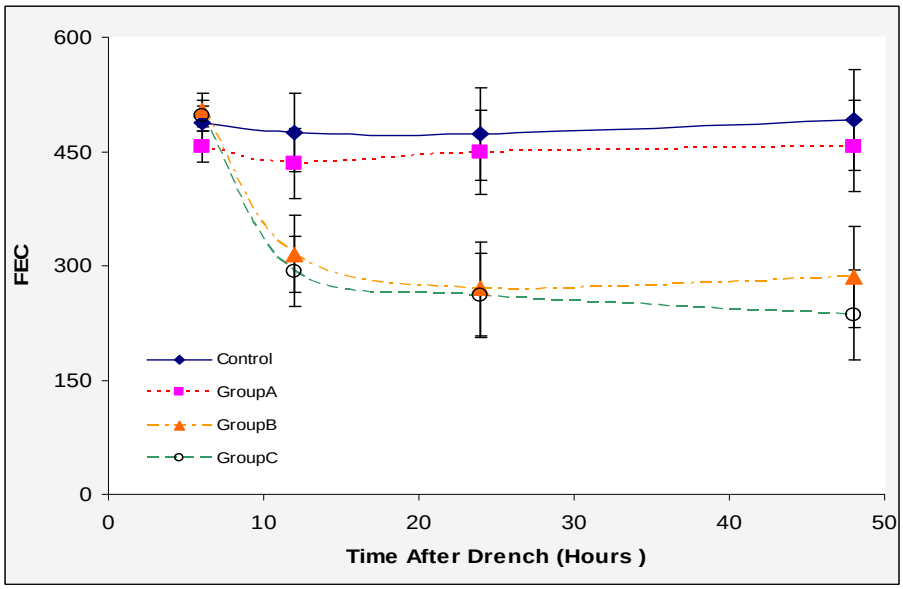
Time Hours After Drenching	**Groups**	**FEC** Mean ± SE *
6	Control	486.84 ± 22.20 ^{ab}
	A	456.50 ± 20.13 ^{ab}
	B	504.61 ± 22.54 ^{a}
	C	497.11 ± 19.86 ^{a}
12	Control	474.97 ± 51.28 ^{ab}
	A	433.91 ± 45.99 ^{ab}
	B	315.64 ± 51.43 ^{b}
	C	293.11 ± 45.87 ^{c}
24	Control	472.84 ± 61.45 ^{ab}
	A	448.64 ± 55.06 ^{ab}
	B	270.15 ± 61.57 ^{de}
	C	261.26 ± 54.96 ^{de}
48	Control	491.70 ± 66.06 ^{ab}
	A	457.29 ± 59.18 ^{ab}
	B	285.23 ± 66.17 ^{cd}
	C	234.90 ± 59.09 ^{e}

A- 1 gr WT/ Kg LBW; **B**- 1.5 gr WT/ Kg LBW; **C**- 2 gr WT/ Kg LBW; * Non similar letters in FEC levels have significant statistical difference (P<0.05).

The effect of WT single dose drench on FEC in Moghani sheep is shown in Table.1.

As it can be observed in Table.1 and Figure.1, administration of 1 gr WT/kg LBW had no significant effect on FEC after 6, 12, 24 and 48 hours after WT drenching (P> 0.05).

Figure 1- Effects of different levels of Wattle Tannin Single Dose Drenching on FEC



Treatment with 1.5 gr WT/kg LBW could cause significant reduction in FEC, from 24 hours after drenching so that its effect remained constant up to end of the study, whereas administration of 2 gr WT/kg LBW demonstrated its efficacy from 12 hours after drenching and reached to the maximum efficacy after 24 hours and then FEC levels remained constant up to the end (P< 0.05). The question of whether the effect of tannins on FEC is an indirect anthelmintic effect, a direct effect, or a combination of both, is a subject of debate among different researchers [8]. The fact of significant reduction in FEC by administration of 1.5 and 2 gr WT/kg LBW can be assumed as an indication that WT has direct effect on GIN, so it can be used as an effective anthelmintic. Similar findings have been reported previously after feeding tanniferous plants to naturally/experimentally infected animals [1-8] but in most of them, the long period effects of tannins or the effects of multiple administrations of different tannins have been investigated. Considering the short time of study (6-48 hours), it can be concluded that the mechanisms of protein supply related to inhibitory effects of tannins against the microbial degradation of diet protein in forestomaches and also too short time for the animals to have elevated immunity against the worms, were not at work in present study and the only probable mechanism is the direct toxicity of WT for naturally acquired GIN. Our results support the results of previous studies that, have clearly demonstrated the time as well as dose dependent anthelmintic effect of different CT containing plant derivatives, against GIN of sheep[1-8]. There are some reports describing that, administration of various commercial tannin preparations as an oral drench has been associated with increased faecal water and mucus content[1], but similar observations were not recorded in our experiments animals. Probably it can bee resulted from different composition of different commercial preparations, For example the amount of hydrolysable tannins content which are known to cause desquamation in the surface epithelium of the intestine and other probable differences in experimented animals and also botanical composition of the grazed pasture.

CONCLUSION

Our findings in beside of WT drenchs negative effect on faecal egg hatchability reported by Max [1] have indicated that away from limited degree of anthelmintic activity of WT drench, it can be assumed as suitable alternative for chemical drugs, in order to treatment of the infected Moghani sheep and decrease in GIN infective larva load in pastures. Also, in order to design appropriate strategies to minimize the GIN related economical losses, more studies is needed to find the native CT containing non toxic plants derivatives/ forages which have acceptable efficacy against GIN in all over the world as well as Iran.

Acknowledgments
This research was carried out as M.Sc thesis in animal science in Islamic Azad University-Shabestar Branch. Authors are grateful to Mr. M. R. Noori for his kindly assistance in providing commercial wattle tannin.

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