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The use of indigenous parasitic plant (*Viscum verrocosum*) in reducing faecal egg counts in female Tswana goats

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Abstract

A study was carried out to evaluate the potential benefit of feeding a diet containing *Viscum verrucosum* on reducing faecal egg count (FEC) in female Tswana goats. Twelve animals, which had naturally acquired intestinal worms, were used in the study that lasted 29 days. Two groups of animals were balanced for live weight and initial FEC and were randomly allocated to Control (n=6; 16.2±1.11kg; 2.88±0.07 FEC) and Treatment (n=6; 16.9±1.11kg; 2.91±0.07 FEC). The animals were individually penned where they were given the experimental diets and clean water each day at 8.00 am. The Treatment group was given a diet containing *V. verrucosum* supplying 8.9 g/d condensed tannins; the Control animals were given a *V. verrucosum* free diet.

There was no significant difference (P>0.05) in daily gain between the groups. The pattern of FEC over the sampling period showed a decrease in the Treatment group while the Control registered an increase in FEC. At the fourth week the difference between the groups tended (P=0.093) towards significance. The effect of *V. verrucosum* on FEC occurred within the first four days after the introduction of the experimental diets indicating that there may a direct anthelmintic effect on the worms.

Parasitic plants, such as *V. verrucosum,* have been fed to small stock by resource-limited farmers and this indigenous knowledge needs to be harnessed to reduce the frequency of use of anthelmintic drugs and to increase effectiveness of these drugs.

Keywords: *anthelmintic, feacal egg count, intestinal worms, Tswana goats,V.verrucosum,*

Introduction

Botswana's national population of goats in 1995 was estimated at 2.6 million of which 99.4% was in the traditional sector (CSO 1999). Goat rearing is an important economic and social activity from which, food, skin, manure and income are derived. Goats are slaughtered at festivals, form part of the rural barter system and provide security during difficult years (Ntseane 1993). Goats require relatively small investment in many areas and the ease of their management makes them attractive to resource-limited farmers especially female-headed households.

The Tswana goat is an indigenous unselected meat-type goat. According to Senyatso and Masilo (1996) they constitute about 80% of the national goat population. Due to high frequency of twinning in the Tswana goat (APRU 1987; Gray 1987a; APRU 1989; Madibela et al 2002a), their numbers can increase rapidly. Their short gestation period means that meat production can be realized in a relatively short period of time. However, the major animal

health impediment to high growth rates is gastrointestinal nematode parasitism (Niezen et al 1998). Endoparasitic control is still heavily reliant on the use of anthelmintic drugs (Butter et al 2000) but for resource-limited farmers in Botswana, anthelmintics are unaffordable. Another constraint to the use of anthelmintics is the increasing drug resistance (Sykes et al 2001; Athanasiadou et al 2000a; Niezen et al 1998) due to frequent administration and misuse of anthelmintics (Butter et al 2000; Atanasio et al 2002). There is also an increasing public concern over drug residues in meat and milk products, and the potential for environmental contamination (McKellar 1997 as cited by Athanasiadou et al 2000a). According to Butter et al (2000) there is a need for sustainable and practical approaches to parasite control that could be introduced in the farming systems. These authors proposed that one such possibility could be the exploitation of forage species capable of reducing worm infection levels solely, or in conjunction with limited use of drugs. It has been reported that feeding forage browse containing condensed tannins reduces faecal egg count in sheep (Sykes and Coop 2001; Athanasiadou et al 2000a; Butter et al 2000; Niezen et al 1998) and in goats (Kabasa et al 2000; Nguyen Kim Lin et al 2003; Seng Sokerya and Preston 2003)).

In this study the potential benefit of feeding a diet containing *Viscum verrucosum*, a parasitic plant known to contain condensed tannins (75g/kg DM; Madibela et al 2002b) was evaluated on female Tswana goats, with naturally acquired intestinal worms.

Material and methods

Location of study

Content Farm, where Botswana College of Agriculture is situated, is located between latitude of 24^{o}33'S and longitude of 25^{o}57'E, at an altitude of 994m above sea level. Mean annual rainfall for the area is about 500mm. Monthly average minimum and maximum temperatures are 12.8 and 28.6^{o} C, respectively.

Experimental animals and management

Twelve Tswana female goats aged between twelve and eighteen months were used in the study, which lasted for 29 days. The animals were sourced from Botswana College of Agriculture farm where animal management is typical of the traditional management system in Botswana (i.e. browsing and grazing with little or no feed supplementation). In addition there are no control measures for external and internal parasites unless infestation is heavy enough to warrant intervention. The twelve animals were blocked in two groups using live weight and were also balanced for faecal egg count (FEC). The two groups were randomly allocated into Control (n=6; 16.2±1.11kg and 2.88±0.07 FEC) and Treatment (n=6; 16.9±1.11kg and 2.91±0.07 FEC). The animals were individually housed in pens measuring about 100 x 150cm with concrete floor and bedding of *Cenchrus cilaris* grass. Each pen had a trough for feed and a bucket for clean water, which was replenished each day. The Control and Treatment goats were given diets (Table 1), which were formulated to contained similar amount of crude protein. The diets were offered at a rate of 700g/d at 8.00 am to allow for refusal of about 20 percent above the estimated intake of 3.5 percent of live weight. This was to allow for selection due to the low quality of the grass hay and wastage.

Table 1. Diet composition (% fresh weight)

	Control	Treatment
Crushed maize grain	40	30.5
Grass hay	44	40
Oil cake	6	0
Molasses	8	8
Urea	1.1	0.85
Salt	0.5	0.5
Dicalcium phosphate	0.5	0.5
V. verrucosum	0	20
Estimated crude protein	11.7	11.7

Sampling procedures

The goats were weighed at the beginning and at the end of the study. Faecal samples were taken at the start of the study and weekly thereafter. The numbers of eggs per gram of fresh faeces were determined according to Nsoso et al (2001). The faecal samples were taken from the rectum and placed in a clean sampling bottle. Five grams of faeces from individual goats were weighed and then crushed with a spoon. Forty-five glass beads were placed in the crushed faecal sample to further improve crushing. Twenty-eight ml of water were added to the sample bottle, which was tightly closed and shaken well. The mixture was sieved through a course sieve into a clean beaker, mixed well and transferred to centrifuge tubes. Centrifugation was done for 3 minutes at 1500 rpm. The supernatant fluid was then decanted and saturated aqueous sodium chloride solution was added to fill the tube up to the former level. Using a pipette a McMaster slide was filled and examination for presence of eggs under a light microscope using a 10x lens was carried out. The eggs were counted according to the modified McMaster method where one egg was taken to represent 50eggs/g fresh faeces (Niezen et al (1998).

Statistical analysis

All data were analysed by using General Linear Model (GLM) of SAS (1990) to find the effect of treatment on FEC and live weight gain. FEC were transformed using $\log_{10}$ (FEC + 1) to normalize the data before analysis.

Results

There was no difference ($P>0.05$) in daily live weight gain between the groups (Table 2). Faecal egg count was not different ($P>0.05$) from week 1 to week 3 but on week 4 the egg count tended ($P=0.093$) to be less in the treatment group compared with the control. Figure 1 shows that the egg count in the goats consuming the diet without *V. verrucosum* was increasing over a period of four weeks while in the goats offered *V. verrucosum* the egg count was decreasing.

Table 2. Least squares means of FEC [$\log_{10}$ (FEC + 1)] live weight and daily live weight gain of female Tswana goats fed diets with (Treatment) or without *V. verrucosum*

	Control	Treatment	SE	P level
Initial weight (kg)	16.2	16.9	1.11	0.687
Final weight (kg)	17.9	18.5	0.98	0.682
Daily gain (g/d)	58.6	56.3	16.29	0.923
FEC Week 1	2.88	2.91	0.07	0.776
FEC Week 2	2.91	2.88	0.07	0.769
FEC Week 3	2.98	2.84	0.08	0.219
FEC Week 4	3.00	2.81	0.08	0.093

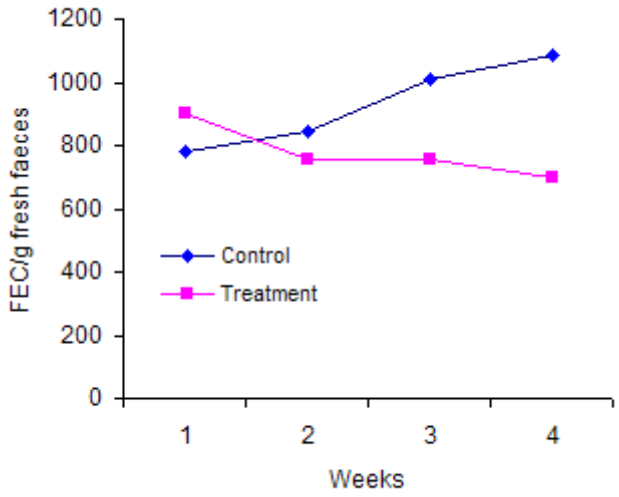

Figure 1. Average FEC of growing female Tswana goats fed diets with (Treatment) and without V. verrucosum

Discussion

Over time the trend in the number of worm eggs showed an increase from week 1 to 4 in Control goats, and a decrease in those fed diets with 20% of *V. verrucosum.* This observation, although over a limited time period, is consistent with other studies comparing diets with and without condensed tannins (Athanasiadou et al 2000a; Butter et al 2000; Kabasa et al 2000; Niezen et al 1998; Seng Sokerya and Rodríguez 2001; Send Sokerya and Preston 2003; Nguyen Kim Lin et al 2003). That the apparent benficial effect was small maybe attributed to the level of condensed tannins supplied by *V. verrucosum*. According to Butter et al (1998), as cited by Athanasiadou *et* al (2000a), consumption of a diet containing 50g/kg DM of quebracho tannins reduced the worm population of lambs infected with a trickle dose of *T. colubriformis*. The inclusion rate of *V. verrucosum* of 20% in the diet and the assumed consumption rate of 590 g/d means that the supply of condensed tannins was 8.9g/d. This amount is lower than the amount apparently found in forages grazed by sheep (Niezen et al 1998) and goats (Kabasa et al 2000) or sheep dosed with a solution of quebracho tannins (Athanasiadou et al 2000a; Athanasiadou et al 2000b). It is possible that an increase in intake of *V. verrucosum,* and therefore of tannins, would have further reduced FEC. It would therefore be of interest to observe the effect of *V. verrucosum* when given in higher concentrations in the diet.

The question of whether the effect of tannins on FEC is an indirect anthelmintic effect, a direct effect, or a combination of both (Athanasiadou et al 2000a) is a subject of debate. The two schools of thought about the mechanism operating in reducing FEC is of an increase in protein supply due to tannin protection of the protein, or a direct action of tannins on intestinal worms. The increased supply of protein is suggested to improve immunity against the worms (Coop and Kyriazakis 1999). The protein content between the two groups of animals was estimated to be similar but nevertheless the Control still recorded an increase in FEC, indicating that the mechanism of protein supply was not at work in the present study. In addition, in the present study, the time period of 29 days is short for the animals to have mounted an effective immunity against the worms, an observation consistent with a study by Anthanasiadou *e*t al (2000b). Butter et al (2000) found no elevation in the immune response animals fed tannins, indicating that there is little enhancement of the immune system due to dietary tannins. Figure 1 shows that a decrease in FEC occurred within the first 4 days after introduction of the diet with *V. verrucosum.* A study by Anthanasiadou et al (2000a) showed that reduction in FEC occurred within two days of the administration of tannins, a period similar to that after treatment with anthelmintic drugs. This indicates that condensed tannins are likely to have a direct anthelmintic effect on the worms. Live weight gains between the two groups were not significantly different but this may have been a reflection of the short period of the study. Anthanasiadou et al (2000a) and Butter et al (2000) also reported this phenomenon. Lack of improved live weight gain suggests that protein availability had not been increased (Butter et al 2000).

Conclusion

- The results support the view that forage plants containing tannins can reduce FEC in small ruminants.
- Parasitic plants, such as *V. verrucusom* belong, have been fed traditionally to small small ruminants by resource-limited farmers and this indigenous knowledge needs to be harnessed to reduce the frequency of use of anthelmintic drugs and to increase effectiveness of these drugs.

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