Potential of controlling intestinal parasitic infections in small ruminants (sheep and goats) with extracts of plants high in tannins.

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Introduction Infections caused by gastrointestinal parasites are major drawbacks hindering livestock productivity worldwide (Gill and LeJambre 1996). Control of helminthiasis is mainly by chemotherapeutic means, with best results being obtained when this is integrated with grazing management, resistant animals and worm vaccines. However, in the last 2 – 3 decades there has been over-dependency and misuse of the chemotherapeutic approach with consequent evolution of anthelmintic resistance (Prichard 1994) especially among major nematode species. Apart from anthelmintic resistance, poor availability and affordability of anthelmintics to under resourced small-scale farmers in developing countries compounds the problem. The use of novel and more sustainable anthelmintics is an alternative approach. Forages rich in condensed tannins (CT) have been found to improve performance of parasitised sheep (Niezen *et al.*,1998). We and others have previously shown that dietary inclusion of the CT in quebracho extract (QT) reduces egg output and worm burden of sheep infected with intestinal parasite *Trichostrongylus colubriformis* (Butter *et al.*, 2000, Athanasiadou *et al.*, 2000). The QT powder is prepared from a tree grown in South America *(Shinopsis balansae)*. The aim of our current collaborative programme is to evaluate the potential of controlling intestinal parasitic infections in small ruminants with plant materials high in tannins or by using extracts from these plants. The specific experiments reported in this abstract studied the effects of short-term administration of QT by drenching on nematode infection (*H. contortus*) in sheep and tested the effect of a Wattle tannin extract, which is readily available in Tanzania, on parasitic worms *in vitro*. *Haemonchus contortus* is a very common abomasal parasite found in the tropics and subtropics.

Material and methods Twenty parasite naïve (Finn Dorset X) ram lambs, about 4 months old (41.9 (sem 1.1) kg) were housed in individual pens and offered a low protein (97g N/kg) feed at 30g/kg liveweight. Following acclimatisation with the diet and new environment, the animals received a daily trickle infection of 450 infective larvae (L_3) of *H. contortus*. Faecal egg outputs (FEC) were monitored and 22 days post-infection the animals were randomly allocated into two groups. The control group (n=10) received a placebo drench (water) whereas the treated group received QT drench at 2.4 g QT kg^{-1} bodyweight (equivalent to 8% (w/w) QT in feed). After 3 days of drenching (days 22, 23 and 24 post infection), all animals were humanely sacrificed the following day (day 25) and worm burdens recovered from the abomasum. Quebracho extract (QT) was supplied by Hodgesons Chemicals Ltd, UK. The data were analysed by one way ANOVA.

The *in vitro* studies were designed to investigate the direct effects of condensed tannins upon survival of GI nematode parasites. Wattle extract (WT) originating from *Acacia mearnsii* was obtained from the Wattle Tannin Co., Tanzania. Adult *Heligmosomoides polygyrus* were used and were freshly obtained each time from passage mice held at the University of Nottingham. The adult mice nematode *H. polygyrus* was used as it was not possible to get routinely a supply of the unsheathed *H. contortus* without killing an infected sheep each time. Briefly, freshly obtained adult worms were incubated on Petri dishes (about 10 –15 male and females) at 39°C in WT solutions of varying strengths prepared in phosphate buffered saline (PBS), final WT concentrations of, 0, 0.5, 1, 2, 4, 8 and 12% (w/v) were used. Survival rates were recorded over different time intervals. Motility and viability of the parasites were assessed by gently prodding the worms using a pointed probe or forceps. The response was recorded as either live or dead, worms were considered dead when, virtually, no reaction to touch was observed.

Results

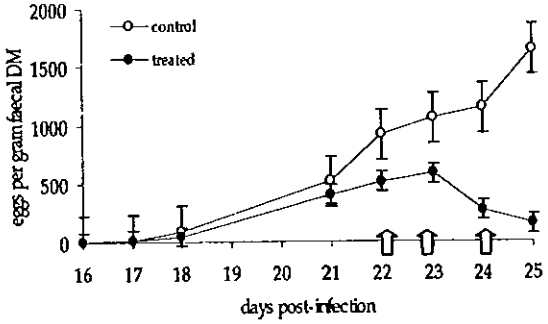

Figure 1

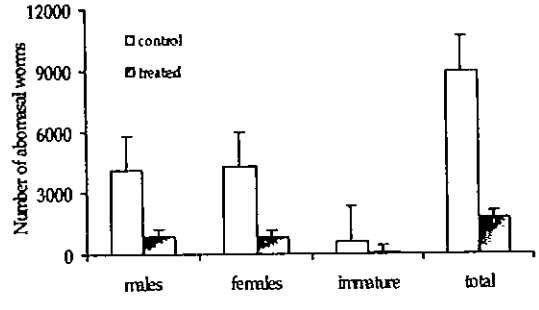

Figure 2

Effect of QT on faecal egg outputs (**figure. 1**), arrows show days of drenching and worm burdens (**figure. 2**) of sheep parasitised with *H. contortus*. Data are Mean +/- SEM.

Worm eggs were first observed in the faeces 17 days after infection. Two distinct egg profiles (p=0.007) were observed (fig. 1), while the FEC of control group increased progressively throughout the 10-day monitoring period, the treated group started to decline two days after the first QT dose. The mean FEC of the treated group after drenching was lower than that of the control group but not statistically different (p=0.06) because of large standard error of difference. Comparison of mean FEC on the day of slaughter (day 25 post infection) showed 91% faecal egg reduction. Worm burden results (figure 2), showed a highly significant difference (p=0.002) between the control and treated groups. There was a reduction of 80% in total worm burden after three days of drenching with QT extract.

The *in vitro* studies showed that all concentrations of WT were toxic to the worms. No worm survived for more than the 10-h incubation in any of the WT solutions (figure 3).

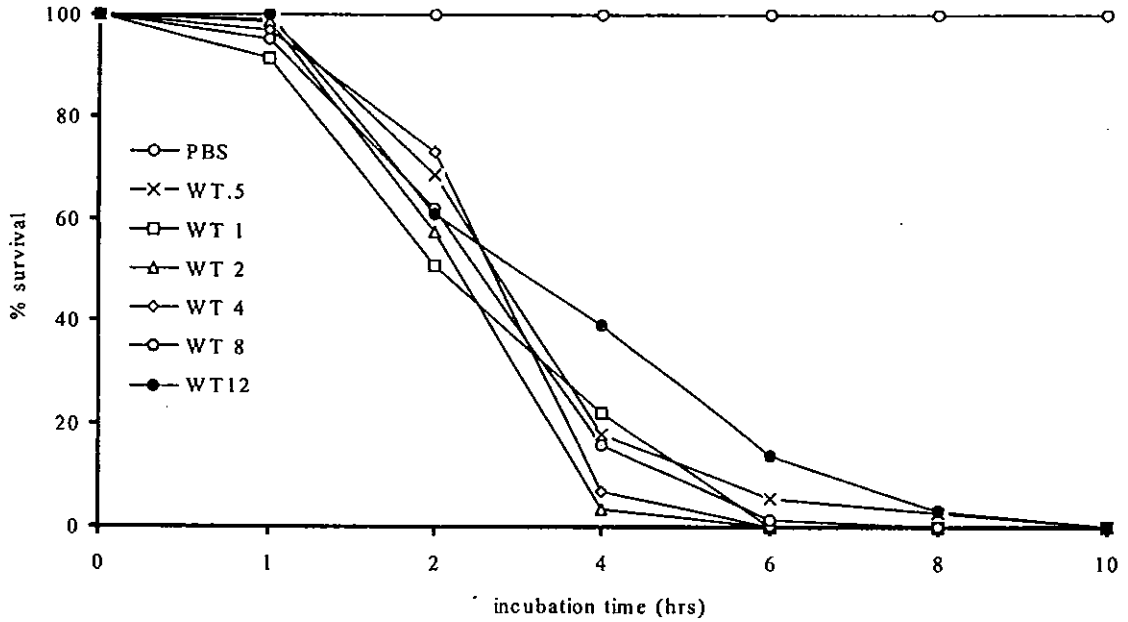

Figure 3 Survival of *H. polygyrus* in culture solutions containing different concentrations (0.5 to 12 % W/V) of wattle tannin extract (WT).

Conclusions The results demonstrate that dietary quebracho tannins can reduce faecal egg output of sheep parasitised with *H. contortus*. The significant reduction in worm burdens is an indication that QT has a direct anthelmintic activity and that drenching may be a quick and effective way of administering the tannin. Wattle tannin, which is readily available from the leather industry in Tanzania, also appears to be toxic to intestinal parasites. *In vitro* studies with WT are required to compare the efficacy of the WT with that of QT, preferably using the goat as the target species. The goat is much more common than sheep among poor resourced livestock farmers in Tanzania and many other parts of Africa. The present findings suggest that it may be possible to design appropriate feeding strategies to utilise tanniniferous materials in the tropics to alleviate helminthiasis.

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