Protein balance of lambs infected with *Haemonchus contortus* and fed tanniniferous sainfoin (*Onobrychis viciifolia*)

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Introduction

By decreasing ruminal proteolysis and increasing the level of free essential amino acids in the blood plasma, condensed tannins (CT) can have a positive influence on protein supply in ruminants (Waghorn *et al.*, 1994). This effect could improve the resilience of sheep infected with gastrointestinal nematodes by compensating for the associated protein loss (Coop and Holmes, 1996). In addition, CT as plant secondary compounds, and CT-containing plants, could have direct anthelmintic properties (Heckendorn *et al.*, 2006). The lack of knowledge concerning the mode of action of CT in ruminants infected with gastrointestinal nematodes represents one constraint for this alternative strategy controlling parasitism in ruminant livestock to be applied. The aim of the present experiment was, therefore, to evaluate the effect of a CT-plant (sainfoin) with known anthelmintic properties on the nitrogen balance of lambs artificially infected with *Haemonchus contortus*. In order to be able to separate between CT and protein effects, sainfoin (197 g crude protein/kg dry matter) was also tested when treated with the CT-binding agent polyethylene glycol (PEG), and was compared with a low-CT lower protein (132 g/kg) grass-clover diet. Uninfected lambs fed the grass-clover mixture served as control.

Material and methods

Twenty-four female lambs of the Swiss White Hill breed (30.5 ± 2.2 kg) were assigned to four treatment groups differing in infection and forage type (n=6). At the start of the experiment, 3 groups of lambs were infected with larvae of the blood-sucking abomasal nematode *H. contortus*. During the first 4 wk, when the infection was allowed to fully establish, all animals received a mixture of grass and white clover. Subsequently, infected lambs were fed dehydrated *Onobrychis viciifolia* (sainfoin; CT-content: 36 g/kg dry matter) without and with PEG (PEG: 100 g/d), or continued to receive the grass-clover mixture. Uninfected lambs also continued to receive the grass-clover mixture. The daily ration consisted of 66 g organic matter from forage per kg metabolic body weight and of 20 g of a mineral mix per d. During wk 7 post infection (p.i.) and after an adaptation period of 2 wk to the experimental diets, feed refusals and faecal and urinary excretions were individually recorded and samples were taken and pooled over the week for analysis of nitrogen. Blood was sampled twice and plasma was analysed for the concentration of free amino acids. The development of the *H. contortus* infection was recorded through weekly determinations of the egg count in the faecal dry matter (FEC). The packed cell volume in blood (PCV) was measured to monitor the severity of infection. The effects of CT, protein level, and infection were evaluated with a contrast model of SAS (GLM). In detail, contrasts compared differences (i) between sainfoin with and without PEG, (ii) between PEG-treated sainfoin and grass-clover mixture in infected lambs, and (iii) between infected and uninfected lambs both receiving the grass-clover mixture.

Results and discussion

Before the feeding of the experimental diets started (wk 4 p.i.), the FEC of the infected lambs averaged at 15.9 ± 5.94 $\times 10^3$ eggs/g while the uninfected lambs remained free of *H. contortus*. The PCV of

the infected groups averaged 0.27 ± 0.022 L/L and was lower (P<0.001) compared to that of the uninfected group (0.32 ± 0.015 L/L). The FEC and PCV showed no significant differences among the 3 treatments after feeding the experimental diets and accounted for 10.5 ± 8.21 $\times 10^3$ eggs/g and 0.31 ± 0.032 L/L on average at the end of wk 7 p.i.. Dry matter intake did not differ among treatments, resulting in a higher N-intake for the lambs fed PEG-treated sainfoin compared to the grass-clover fed lambs due to the differences in feed N-content. The feeding of the sainfoin with PEG in comparison to grass-clover increased (P<0.001) urinary and total N-excretion, but also N-retention. Treating sainfoin with PEG lowered faecal N-excretion (P<0.05) but had no influence on urinary N-excretion. However, the proportion of urinary N (mg/g N excreted) was higher (P<0.05) with PEG-treated sainfoin than with untreated sainfoin. Between infected and not infected lambs fed with grass-clover, no difference (P>0.05) in N-balance was found. Plasma levels of arginine were lower (P<0.05) and those of threonine and tryptophan were higher (P<0.05) in uninfected compared to infected lambs fed grass clover. The CT-effects (+/-PEG) in sainfoin-fed lambs were very low compared to those observed in other experiments (e.g., Waghorn, *et al.*, 1994), which may suggest that the CT in the tested sainfoin were of low activity. This could also have reduced the anthelmintic potential recently demonstrated for sainfoin (Heckendorn *et al.*, 2006). The lack of differences in the N-balance between infected and uninfected lambs contrasts clearly with the effects of gastrointestinal nematode infections on protein metabolism described by Louvandini *et al.* (2006). A possible explanation for these contrasting results could be that in the study of Louvandini *et al.* (2006) two parasites (*Trichostrongylus colubriformis* and *H. contortus*) were investigated. Furthermore, the infection might not affect absorption but utilisation of the absorbed N-compounds (Colditz, 2003).

In conclusion, the unexpected lack of an influence of feeding sainfoin to infected lambs suggests that the possibilities of enforcing the resilience of hosts infected with *H. contortus* by improving the supply with protein, either directly or via feeding CT, are not always efficient. However, it might be that the exertion of the effect needs a longer period of time of feeding a CT-rich plant.

References

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