IN VIVO ASSESSMENT OF THE ABILITY OF TANNIN TO INTERFERE WITH THE DIGESTION OF PROTEIN POST-RUMINALLY

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Tannins are plant metabolites that precipitate protein and as such interfere with protein digestion. At rumen pH, tannins are understood to bind readily to protein, hence protecting it from complete degradation by rumen microbes and providing potentially valuable 'rumen escape' protein. However, escape protein is only valuable if it is readily digested post-ruminally. There is evidence that some tannins release protein in response to the low pH environment of the abomasum, for example *Lotus pedunculatus* tannin (Barry *et al.* 1986), so that the process of protein digestion can commence, but others, such as tannin from *Acacia aneura* may not (Pritchard *et al.* 1992). The excellent performance of cattle on Leucaena leucocephala suggests *Leucaena* tannin may act in a similar way to Lotus tannin (Wheeler *et al.* 1994). We compared the abilities of *Leucaena, A. aneura* and *Lotus* tannin to release protein post-ruminally by complexing them with protein, dispensing them into the abomasum of sheep and collecting digesta from the terminal ileum to estimate the percent of complexed protein that had been digested and thus released from each tannin.

Individual infusion solutions were prepared by complexing 30 mg of tannin extracts from four legume species (Table 1) with 30 mg of ^{15}N enriched plant protein in 18 mL of a sodium acetate buffer (pH = 5.0) and adding it to 3 mg of the indigestible marker CrEDTA in 3 mL of water. Control solutions were prepared which contained the enriched protein and CrEDTA but no tannin. Two or three sheep received each treatment and a given sheep was treated only once per day. Solutions were injected via an abomasal cannula at 1400 hours and digesta collected from the terminal ileum about every half hour from 1.5 to 4 hours post-injection. The sample with the highest concentration of CrEDTA was selected for analysis of ^{15}N content. The digestibility of the infused ^{15}N protein for each treatment was determined by measuring the degree to which the ratio of CrEDTA:^{15}N decreased between the abomasum and the ileum; thence percent digestibility = 1-(ratio infused/ ratio collected). The concentration of ^{15}N at the ileum was corrected for background levels of ^{15}N, estimated from the digesta of three sheep to be 0.3686 % of total N atoms in the DM. The tannins used were extracted with 70% acetone and purified with a Sephadex LH-20 column from lyophilised leaf tissue of the four species. The ^{15}N enriched plant protein (1.6% of N atoms as ^{15}N) was prepared by growing the low tannin species *Leucaena collinsii* (OFI 52/88) in a hydroponic solution containing $(NH_4)_2SO_4$ enriched with 10% of N atoms as ^{15}N, and purifying the resultant leaf protein. The sheep were on a basal diet of lucerne chaff fed once daily (0800 hours) at a rate of 800 g/day.

Tannin from *A. aneura* and *L. diversifolia* reduced the digestibility of protein compared to that of protein infused without tannin. The deleterious effect of *A. aneura* tannin is consistent with *A. aneura* foliage being at best a maintenance feed, despite its high protein content. *L. diversifolia* could have a similarly poor feeding value compared to *A. aneura*, given that their tannins depressed protein digestibility to similar extents. However, tannin from *L. leucocephala* and *Lotus pendunculatus* may be categorised as valuable as they can promote more digestible rumen-escape protein.

We conclude that some tannins can reduce the true digestibility of plant protein post-ruminally to a greater extent than others. With further refinement of the above technique we expect to be able to more accurately rank the effects of specific tannins on protein digestibility.

Table 1. Ability of tannins to interfere with the digestibility (%) of protein post-ruminally

Tannin source	n	Digestibility
Leucaena diversifolia (OFI 53/88)	3	77.8 [a]
Acacia aneura (Mulga)	3	77.7 [a]
Lotus pedunculatus cv. Maku	2	86.9 [ab]
Leucaena leucocephala cv. Tarramba	3	88.3 [ab]
Control (no tannin)	2	94.2 [b]
s.e.m. (n=3)		4.7

Values within columns followed by different letters are significantly different at $P < 0.10$

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