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Deactivation of Ingested Forage Condensed Tannins in Pregnant Goats selectively Browsed in a Savannah Range Land affects their Productive Performance

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Abstract
During browsing in natural systems (major ruminant feeding grounds in sub-Saharan Africa), ungulates, including goats, generally reject feed-stuffs containing more than 5% condensed tannins (CT). This 5% rejection level coincides with the CT ceiling below which improved protein and amino acid utilisation in ruminants has been observed. Our investigations focused on the hypothesis that, under normal selective feeding in a natural ecosystem such as the range lands, browsing ungulates derive benefits from the ingested CT. The study was done in the Ankole range land in Uganda. Thirty yearling F1 Anglo-Nubian x Mubende goats averaging 21 ± 0.45 kg, were screened, effectively treated against helminth parasites, mated and randomly divided into 2 equal groups during a 3 months preparatory phase. During the 6 months that followed, goats of one group received 50 g per goat and day of a CT deactivator (adsorbent) - polyethylene glycol (PEG) and the other acted as the control (no PEG). Goats were monitored for their nutritional status and productive characteristics during and after gestation. Group comparison tests were done by ANOVA. Deactivation of ingested condensed tannins in pregnant goats selectively browsed in the range land elicited a significant ($p<0.05$) reduction in their productive performance. Birth weight was reduced, kids mortality at birth increased and postpartum recovery of the does was delayed. The weight loss was up to 19% during lactation and 11% after weaning. While the control goats attained a net live weight gain by the 11th week postpartum, those of the PEG group were delayed until the 15th week. Consequently, the common view that tannins are associated with negative effects in ruminants should be interpreted with caution when dealing with the seasonal effects of tannins in browsing range land goats. Other anti-nutritional factors in browse feed may, however, hinder the manifestation of tannin induced benefits in browsing goats.

Key words: ruminant nutrition, condensed tannins, goats, range lands, sub-Saharan Africa

Introduction
During normal grazing in natural range land systems (the major ruminant feeding grounds in sub-Saharan Africa), browsing goats generally reject feed-stuffs containing more than 5% condensed tannins (CT) (**Cooper and Owen-Smith, 1985**). However, this 5% rejection level coincides with the CT ceiling below which improved protein and amino acid utilisation in ruminants has been observed (**Waghorn, 1990**). Our investigations focused on the hypothesis

that, under normal selective feeding in a natural range land ecosystem, browsing goats derive benefits from the ingested CT.

Materials and methods

1. Study area: The study was done in the Ankole range land in southern Uganda (Fig.1). Dominant vegetation species included among others Acacia *ssp*, Grewia *ssp*, Cadaba *ssp*, Rhus *ssp*, and Carissa *ssp* (**Schwartz et al., 1996**).

2. Experimental procedures: Thirty yearling F1 Anglo-Nubian x Mubende range does averaging 21 ± 0.45 kg, were screened, effectively dewormed, mated and randomly divided into 2 equal groups during a 3 months preparatory phase. During the 6 months that followed, one group received a daily oral dose of a CT deactivator, polyethylene glycol (PEG) of molecular weight 4000, and the other acted as the control (no PEG). Goats were grazed in the range land and monitored for their nutritional status and the pre- and post-partum productive characteristics (weight and reproductive changes). Tests for group comparison were done by ANOVA. Sigmastart statistical package (**Jandel Corp., 1995**) was used. Tukey test was used for all pairwise comparisons.

Results

Deactivation of ingested condensed tannins in pregnant goats selectively grazed in the range land elicited a significant ($p<0.05$) reduction in their productive performance. Kids mortality at birth increased (Fig. 2) and postpartum recovery of the does was delayed (Fig. 3). The weight loss was up to 19% during lactation and 11% after weaning (Table 1). While the control goats attained a net live weight gain by the 11th week postpartum, those of the PEG group were delayed until the 15th week.

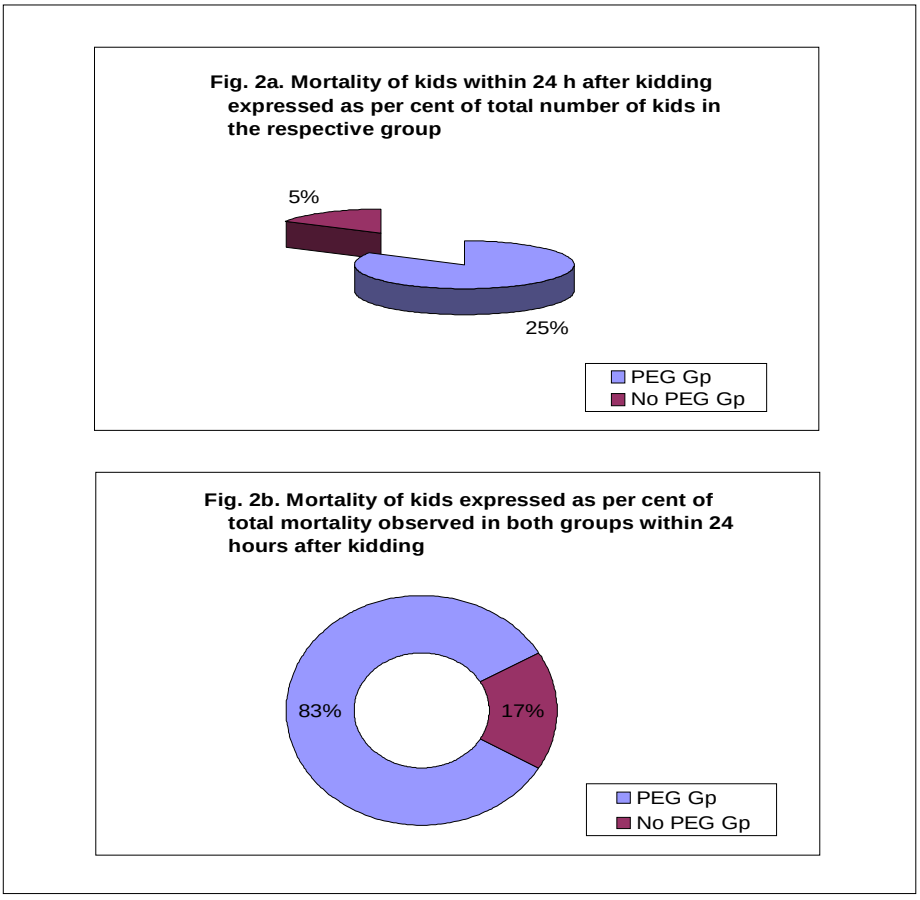

Fig. 3. Post-partum cummulative weight loss or gain of range does fed browse containing condensed tannins. PEG group had been drenched daily with polyethylene glycol during gestation.

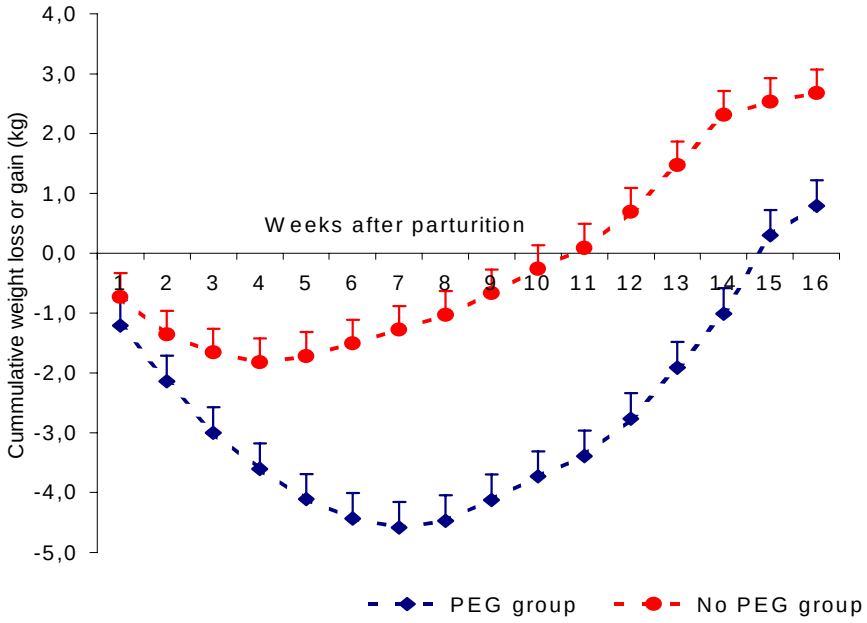

Table 1: Postpartum percent loss in live weight of range does drenched with or without polyethylene glycol during gestation

PARAMETER	WT AFTER BIRTH	MONTH 1	MONTH 2	MONTH 3	MONTH 4
PEG group live weight (kg) ± sem	25.45 ±0.13	21.85 ±0.22	20. 95 ±0.26	22.65 ±0.30	24.65 ±0.35
No PEG Gp live weight (kg) ± sem	25.95 ±0.31	24.15 ±0.27	24.95 ±0.28	26.65 ±0.26	27.35 ±0.32
Percent loss*; PEG relative to No PEG Gp	-1.96 ±0.11	-10.53 ±0.18	- 19.09 ±0.25	- 17.66 ±0.27	-10.95 ±0.25
Percent loss within the PEG Gp		- 15.72 ±0.2	- 17.68 ±0.23	- 11.00 ±0.13	- 3.14 ±0.14
Percent loss within the No PEG Gp		- 6.94 ±0.22	- 3.85 ±0.24	+ 2.7 ±0.12	+ 5.1 ±0.23

* Percent loss is indicated by a minus sign, WT = weight; Gp = group.

Discussion

It is known that under normal selective grazing, goats prefer browsing low fibre trees and shrub species (**Lohrmann, 1986**). The intake of low fibre material keeps the intake of polyphenols low since fibre and polyphenols in browse are positively correlated (Reed, 1986). When the CT intake is < 5%, improvement in protein and amino acid utilisation in ruminants is observed (**Waghorn, 1990**). It would thus appear, that under normal selective feeding in a natural Savannah range land ecosystem, browsing goats control the amount of CT ingested and optimise their beneficial effects. The common view that tannins are associated with negative effects in ruminants should be interpreted with caution when dealing with the seasonal effects of tannins in browsing range land goats. Other anti-nutritional factors in browse feed may, however, hinder the manifestation of tannin induced benefits in browsing goats.

Conclusions

1. Selectively fed browse CT in the Ankole range land ecosystem lead to improved pre- and postpartum productive characteristics of browsing pregnant goats

2. Browse CT are an important epidemiological factor influencing the productive characteristics of grazing goats.

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