

**EFFECT OF POLYETHYLENE GLYCOL 4000 SUPPLEMENTATION ON
THE PERFORMANCE
OF INDIGENOUS PEDI GOATS FED DIFFERENT LEVELS OF ACACIA
KARROO
LEAF MEAL**

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ACACIA KARROO TREE

(Source: Barnes *et al.*, 1996)



OUTLINE

1. Background

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BACKGROUND

- Indigenous goats play multiple roles in the livelihoods of many smallholder farmers (Brown *et al.*, 2016).
- The productivity of these goats is constrained by shortage of good quality feed (long dry season).
- Earlier studies have shown that Pedi goats lose weight and condition during this period (Gwanzura, 2011).
- Alternative feed sources must be provided to alleviate the nutritional problem.

- Browse plants have the potential to alleviate feed shortages and nutritional deficiencies (Belachew *et al.*, 2013).
- *Acacia karroo* (AK), an indigenous legume specie is widely spread and abundantly available during the dry season (Ngambu *et al.*, 2012). **Ecological threat to natural rangelands, invasive species, eradication.** Paradigm shift (Utilization as a protein supplement).
- The leaves contains high concentration of CP (100-250 g/kg DM) and minerals (Mapiye *et al.*, 2011).

Chemical composition of *Acacia karroo* and *Setaria verticillata* hay (% DM Basis)

Composition	<i>Acacia karroo</i> leaves	<i>Setaria verticillata</i> grass hay
Dry matter	97.01	96.23
Organic matter	92.14	91.37
Crude protein	12.65	7.97
ADF	32.47	50.68
NDF	38.01	77.88
Condensed tannin*	2.0	ND
Total Phenolic**	1.95	ND
Ca	1.64	0.53
Mg	0.34	0.23
k	1.24	1.01
Na	0.05	0.01

*: Condensed tannin as % DM Leucocyanidin equivalent

** : Expressed as tannic acid equivalent (%)

Source: Brown et al. (2016)

- AK has potential to increase productivity of goats feeding on low quality roughages.
- However, their use as protein supplements is restricted by the high content of condensed tannin (CT) in their foliage (Mokoboki, 2005).
- High intake of CT by ruminants may depress FI, digestibility of diets and affect productivity of the animals (Etuk *et al.*, 2012; Waghorn, 2008). **Liver necrosis, lesions & kidney damage** (Karimi *et al.*, 2014).

- The negative effects posed by high tannin contents in feeds must be overcome to improve the feeding value.
- Tannin-binding compounds such as polyethylene glycol (PEG) has potential to neutralize the negative effects of CT present in forage legumes (Tshabalala *et al.*, 2013).
- PEG is an inert unabsorbed molecules that can form stable complex with tannins. Prevent binding btw tannins & proteins/release protein from tannin-protein complex (Yisehak *et al.*, 2013).

- PEG 4000 has been used to alleviate negative effects of CT by several authors (Decandia *et al.*, 2000; Motubatse *et al.*, 2008).
- However, other authors have found that PEG 4000 supplementation does not improve performance of animals on tannin-rich diets (Barry *et al.*, 2001; Bhatta *et al.*, 2002).
- The objective of the study was to determine the effect of PEG 4000 supplementation on the performance of Pedi goats.

METHODOLOGY

- The study was conducted at the University of Limpopo experimental farm.
- Eighteen yearling male goats with a mean LW of 21.76 ± 3.1 kg were randomly allocated to 6 treatments in a 2 (*Acacia karroo* leaf meal levels) x 3 (levels of PEG 4000) factorial arrangement, in a CRD.
- Each treatment had 3 replicates with 1 goat per replicate.
- The experiment lasted for 21 days , consisting of a 14-day adaptation period and 7 days of data collection.

NUTRIENT COMPOSITION OF THE EXPERIMENTAL DIETS (% DM BASIS) FED TO PEDI GOATS

TREATMENT		
Nutrient	S80A20	S50A50
Dry matter	95.24	97.01
Organic matter	91.52	91.75
Crude protein	8.90	10.37
ADF	47.03	41.57
NDF	69.90	57.94
Condensed tannins*	0.41	1.02
Total Phenolic**	0.39	0.98

FEED COMPOSITION OF THE EXPERIMENTAL DIETS

DIET CODE	DIET DESCRIPTION
A ₂₀ S ₈₀ P ₀	A diet having a mixture of 20 % <i>Acacia karroo</i> and 80 % <i>Setaria</i> grass and not supplemented with PEG 4000
A ₂₀ S ₈₀ P ₂₃	A diet having a mixture of 20 % <i>Acacia karroo</i> and 80 % <i>Setaria</i> grass and supplemented with 23 g of PEG 4000/goat/day
A ₂₀ S ₈₀ P ₃₀	A diet having a mixture of 20 % <i>Acacia karroo</i> and 80 % <i>Setaria</i> grass and supplemented with 30 g of PEG 4000/goat/day
A ₅₀ S ₅₀ P ₀	A diet having a mixture of 50 % <i>Acacia karroo</i> and 50 % <i>Setaria</i> grass and not supplemented with PEG 4000
A ₅₀ S ₅₀ P ₂₃	A diet having a mixture of 50 % <i>Acacia karroo</i> and 50 % <i>Setaria</i> grass and supplemented with 23 g of PEG 4000/goat/day
A ₅₀ S ₅₀ P ₃₀	A diet having a mixture of 50 % <i>Acacia karroo</i> and 50 % <i>Setaria</i> grass and supplemented with 30 g of PEG 4000/goat/day

CHEMICAL ANALYSIS

- DM, OM, CP and Ash (AOAC,2005)
- Fibre components (Van Soest et al., 1994)
- Total phenolic contents (Folin-Ciocalteus method and expressed as tannic acid equivalent-Makkar *et al.*, 1993)
- CTs content (Butanol-HCl method and expressed as leucocyanidin equivalent- Porter et al., 1993)
- Serum urea by the method of Valley *et al.*, (1980);
Blood glucose by enzymatic colorimetric test.

STATISTICAL ANALYSIS

- The effects of PEG 4000 supplementation, level of *Acacia karroo* leaf meal inclusion and their interactions on intake, growth rate, serum urea and blood glucose of Pedi goats were analyzed using GLM Procedures of SAS (2010).
- Where significant treatments were detected, means were separated by Fisher's LSD.

RESULTS AND DISCUSSION

Effects of PEG 4000 supplementation and *Acacia karroo* inclusion on diet intake of Pedi goats fed a *Setaria verticillata* grass hay-based diet

TREATMENT							
Variable	A ₂₀ S ₈₀ P ₀	A ₂₀ S ₈₀ P ₂₃	A ₂₀ S ₈₀ P ₃₀	A ₅₀ S ₅₀ P ₀	A ₅₀ S ₅₀ P ₂₃	A ₅₀ S ₅₀ P ₃₀	SEM
Intake (g/goat/day)							
DM	495 ^{bc}	766 ^a	696 ^{ab}	593 ^{abc}	394 ^c	486 ^{bc}	82.54
OM	453 ^{bc}	701 ^a	637 ^{ab}	544 ^{abc}	362 ^c	445 ^{bc}	75.59
CP	44	68	62	61	40	50	7.89
NDF	346 ^{bc}	535 ^a	486 ^{ab}	343 ^{bc}	228 ^c	282 ^c	54.12
ADF	233 ^{bc}	361 ^a	327 ^{ab}	246 ^{abc}	164 ^c	202 ^c	37.11

RESULTS AND DISCUSSION CONT'D

Effects of PEG 4000 supplementation and *Acacia karroo* inclusion on digestibility of Pedi goats fed a *Setaria verticillata* grass hay-based diet

TREATMENT							
Variable	A ₂₀ S ₈₀ P ₀	A ₂₀ S ₈₀ P ₂₃	A ₂₀ S ₈₀ P ₃₀	A ₅₀ S ₅₀ P ₀	A ₅₀ S ₅₀ P ₂₃	A ₅₀ S ₅₀ P ₃₀	SEM
Digestibility (decimal)							
DM	0.72 ^{bc}	0.74 ^{ab}	0.76 ^a	0.71 ^c	0.70 ^c	0.71 ^{bc}	0.009
OM	0.73 ^{bc}	0.75 ^{ab}	0.77 ^a	0.73 ^{bc}	0.70 ^c	0.71 ^{bc}	0.011
CP	0.66 ^{ab}	0.71 ^a	0.67 ^{ab}	0.59 ^c	0.55 ^c	0.62 ^{bc}	0.023
NDF	0.68 ^b	0.72 ^{ab}	0.73 ^a	0.60 ^c	0.61 ^c	0.61 ^{c^{bc}}	0.012
ADF	0.68	0.70	0.71	0.57	0.61	0.67	0.042

RESULTS AND DISCUSSION CONT'D

Effects of PEG 4000 supplementation and *Acacia karroo* inclusion on live weight change, serum urea and glucose (mmol/L) of Pedi goats fed a *Setaria verticillata* grass hay-based diet

TREATMENT							
Variable	A ₂₀ S ₈₀ P ₀	A ₂₀ S ₈₀ P ₂₃	A ₂₀ S ₈₀ P ₃₀	A ₅₀ S ₅₀ P ₀	A ₅₀ S ₅₀ P ₂₃	A ₅₀ S ₅₀ P ₃₀	SEM
Initial LW (kg)	20.7	23.4	22.5	21.8	20.4	21.9	1.544
Final LW (kg)	21.5	24.2	23.1	22.8	21.4	22.9	1.625
LWG (g/goat/day)	40.0	38.0	30.3	49.6	46.3	49.3	12.35
Urea	3.0	2.6	2.5	2.8	3.3	2.5	0.450
Glucose	2.6	2.8	2.9	2.8	2.8	2.8	0.082

IMPLICATION

- Inactivation of tannins through PEG increased availability of nutrients to the animal.
- Supplementation with 23 g of PEG 4000 improved DM, OM, NDF and ADF intakes of goats on a dietary mixture of 20% AK and 80% Setaria grass.
- Supplementation with either 23 or 30 g of PEG 4000 improved DM, OM, CP and NDF digestibility of goats on the same dietary treatment.
- Supplementation with either 23 or 30 g of PEG 4000 did not improve the performance of the goats fed a dietary mixture of 50% AK and 50% Setaria grass.

- It is possible that PEG 4000 was not enough to have effect of the performance of goats fed 50% AK and 50% Setaria grass.
- Additionally, the high amount of tannin in that diet may have exerted adverse effects on the performance of the goats.

THANK YOU!!!