The use of polyethylenoglicol to reduce the anti-nutritional effects of tannins in Cistus Ladanifer L.

Maria T.P. Dentinho [1,3*]; Olga Moreira[1]; Rui Bessa[2,3]

[1] INIAV, Unidade Estratégica de Investigação de Produção e Saúde Animal;

[2] Faculdade de Medicina Veterinária da Universidade de Lisboa

[3]Centro Interdisciplinar de Investigação em Sanidade Animal (CIISA)

** teresa.dentinho@iniav.pt*

Rock rose (*Cistus Ladanifer* L.)

- Abundant shrub in marginal fields of Mediterranean countries
- Without regular economic exploitation
- Highly combustible => forest fires
- Not grazed due to low nutritive value
- High levels of tannins

Tannins

- Phenolic plant secondary compounds
- Ability to form complexes with proteins and other nutrients
- Decrease the feed intake, nutrient utilisation and animal performance

Polyethylene glycol (PEG) - Inert molecule that forms complexes with tannins preventing their binding with other molecules - remove the anti-nutritive effects

Objectives

- To evaluate the impact of rockrose tannins on:
  - -Ruminal degradability and
  - Ruminal fermentation characteristics.
- To remove the anti-nutritive effects of tannins using polyethylene glycol (PEG)

Conclusions

- Tannins have a strong negative effect on nutrients degradation and ruminal fermentation of rockrose.
- PEG treatment seems to neutralize tannins allowing better utilization of rockrose in ruminant diets.
- PEG inclusion level of 5% appears to be sufficient to prevent negative effects of rockrose tannins

Results

Table 1 - Chemical composition (g/kg DM) and in vitro organic matter digestibility (OMD) of rockrose treated with 0, 25, 50 and 75 g/kg of PEG in dry matter.

	0	25	50	75
Dry matter (g/kg)	905	909	916	917
Organic matter	959	960	961	962
Crude Protein	70.4	68.8	66.5	64.9
Sugar	57.4	61.5	61.8	59.6
NDF	301	308	376	384
ADF	272	242	249	248
Total phenols [1]	108	87.3	67.4	67.4
Total tannins [1]	87.7	70.2	48.4	47.2
Condensed tannins [3]	207	138	82.6	80.5
Total tannins (radial diffusion) [1]	43.8	43.3	nd	nd
OMD (%)	50.6	53.5	55.1	54.6

[1] Tannic acid equivalent in g/kg DM; [2] catechin equivalent in g/kg DM
[3] Abs_{550nm}/g DM; nd – not detected

Table 2 - *In situ* ruminal degradation of organic matter and crude Protein

	0	25	50	75
Organic matter				
a[1]	37 [ab]	36[a]	36[a]	38[b]
b[1]	46[c]	44[ab]	45[bc]	43[a]
c [2]	0.023[a]	0.035[b]	0.048[c]	0.049[c]
$P_{0.02}$[1]	61[a]	64[b]	67[c]	68[c]
$P_{0.05}$ [1]	51[a].	55[b]	58[c]	59[c]
Crude Protein				
a [3]	17	15	19	16
b [3]	71[b]	68[b]	58[a]	60[a]
c [2]	0.013[a]	0.018[ab]	0.027[bc]	0.035[c]
$P_{0.02}$[3]	45[a]	47[a]	52[b]	54[b]
$P_{0.05}$[3]	31[a]	33[a]	39[b]	40[b]

[1] % of OM; [2] h^{-1}; [3] % of CP; a- rapidly degraded fraction,; b- slowly degraded fraction ; c- rate of degradation of the b fraction ; P effective degradability measured at rumen outflow rates k = 0.02 and 0.05 h^{-1}.
a,b,c - values in the same row with different letter are significantly different (P < 0.05).

Table 3 – In vitro OM and CP disappearence and ruminal characteristics

	0	25	50	75
Disappearance (48 h) (%)				
OM	37[a]	40[b]	40[b]	42[c]
CP	12	13	13	15
VFA mmol/day				
Acetate	8.6[a]	16.6[b]	19.3[b]	22.4[b]
Propionate	3.0[a]	6.2[b]	6.1[b]	6.8[b]
Acetate:Propionate ratio	2.8[ab]	2.7[a]	3.1[bc]	3.3[c]
Total VFA	12.[a]	24[b]	27[b]	31[b]
NH3-N (mg/dia)	122	110	120	115
Gas (l/day)	1.6[a]	1.9[b]	1.9[b]	2.0[b]

a,b,c - values in the same row with different letter are significantly different (P < 0.05).

Material and Methods

Material

- Aerial parts of rockrose plants (leaves and soft steams)
- Treatment - 0, 25, 50 and 75g of $PEG_{20,000}$/kg of dry matter

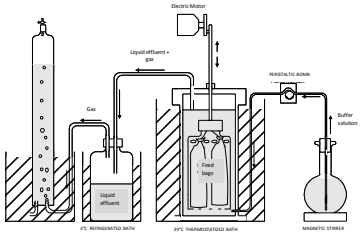
Ruminal in situ degradability

- Animals- Three Merino rams fitted with permanent ruminal cannula
- Diet- lucerne pellets
- Equipment - Nylon bags 40 µm pore size
- Sample in bags - 3g
- Ruminal incubations time - 2, 4, 6, 8, 16, 24, 48, 72, 96 h
- Chemical analysis in feed and bag residues – DM, ash, N
- Ørskov and McDonald (1979) model - '$p= a + b (1-e^{-ct})$' and

  Effective degradability (P) = a + [bc/(c + k)]

  a - rapidly degraded fraction
  b - slowly degraded fraction
  c- rate of degradation of the b fraction
  K - outflow rate from the rumen

In vitro study - Rusitec



- Rumen fluid donors - three Merino rams
- Diet – lucerne pellets
- Nylon bags - 16 x 8cm, 150 µm pore size
- McDougals' buffer solution (pH 7.0)
- Sample in bags – 15 g
- Chemical analysis :

  Feed and residues – dry matter (DM), ash, N, NDF

  Effluents - NH3-N , volatile fatty acids (VFA)
- Gas production

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