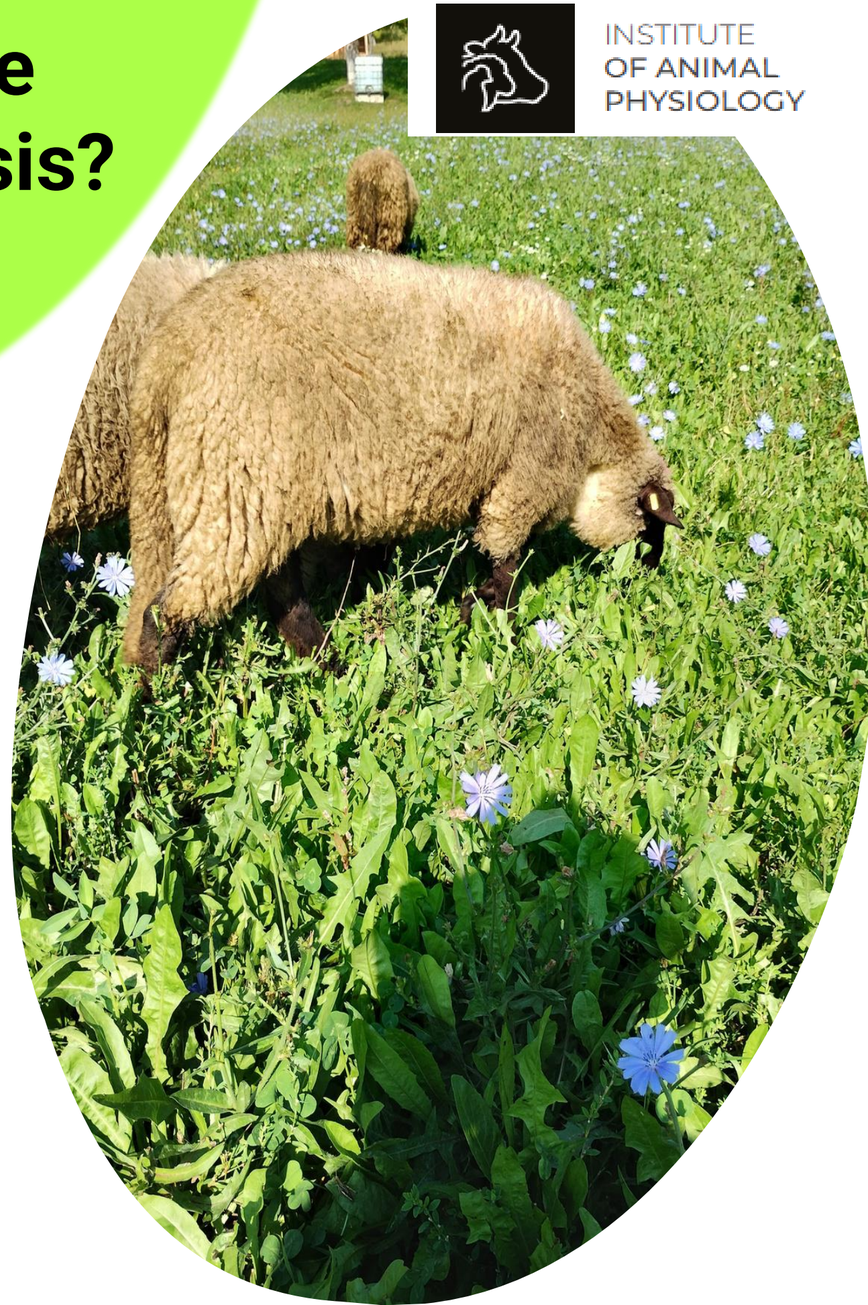
Can effective grazing management affect the rumen environment in lambs with haemonchosis?

Daniel Petrič

Institute of Animal Physiology
Centre of Biosciences of Slovak Academy of Sciences



EAAP European Federation of Animal Science

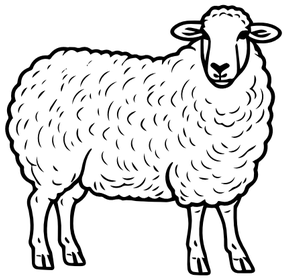
3rd EAAP Regional Meeting 2025

Animal Production in the Changing World
April 9th - 11th , 2025 - Krakow (Poland)

BACKGROUND

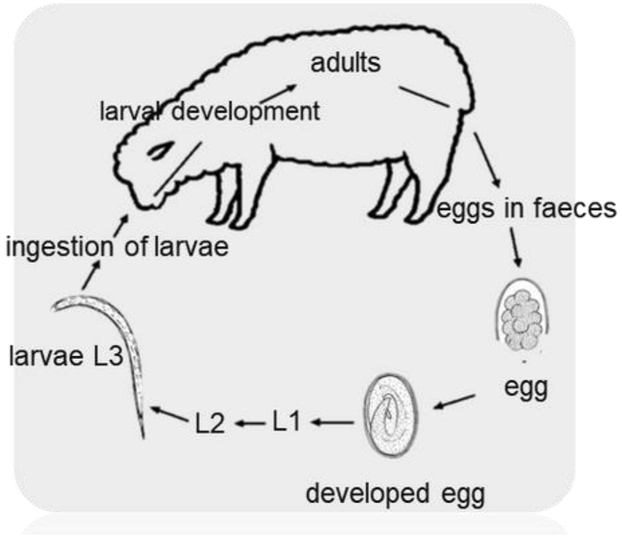
Polyphenols

- Plant species diversity - sources of phytochemicals
- Self-medication of grazing ruminants
- Reducing the use of synthetic chemicals
- Organic farming systems



Gastrointestinal nematodes (GIN)

Heamonchus contortus - haemonchosis



GIN can affect:
Feed intake
Nutrients consumption
Retention time in the rumen

Adults of *H. contortus* adhered to abomasal wall

Hypothesis:

Grazing lambs on meadow grassland enriched with experimentally sown chicory can beneficially change the growth performance and ruminal microbial fermentation of lambs with endoparasites

AIM OF STUDY

- Growth performance in lambs with endoparasites grazing on meadow grassland enriched with experimentally sown chicory
- Ruminal fermentation and microbiota of grazing lambs

CONTROL and EXPERIMENTAL PLOTS

EXPERIMENTAL PLOT - 4220 m²

Meadow grasslands

CONTROL PLOT - 4217 m²

25 % of total area was recultivated with chicory (81,5%), sainfoin (14,8%) and alfalfa (3,7%)

Experimental mix of chicory, sainfoin and alfalfa seeds used for recultivations of Experimental plot

EXPERIMENTAL DESIGN

Animals: 16 Tsigai breed lambs (rams and ewes 1:1, age 3-4 months, weight 13.6 ± 0.52 kg)
Housing: Commercial farm (PETLAMB–Petrovce, Prešov district, Slovakia)
Experimental groups: 2 groups of lambs (Control and Chicory)
Day 0: Experimental infection of all lambs with approx. 5000 larvae of *H. contortus* (L3)
Day 0 - 145: Diet consisted of concentrate (350 g/kg DM/d), ad libitum grazing with free access to water
Regular *sampling (blood, feces) and weighing*

Adaptation (7 Days)

Experimental infection

2 Groups

Experiment - Sampling

Slaughtering (after 145 Days)

Analysing of Samples

ANALYSES

Chemical nutritional values of feed substrates - DM, ADF, NDF, CP, N, Ash

Plant species diversity analyses

Phytochemical analysis of pastures - UHRMS

Ruminal fermentation analyses - SCFAs, NH3, pH

Microbial analyses and quantification - Protozoa (microscopicaly), Bacteria, Archea (RT-PCR)

Histopathology of ruminal and abomasal tissues

RESULTS

Table 1
Plant families on meadow grassland and main phenolic compounds

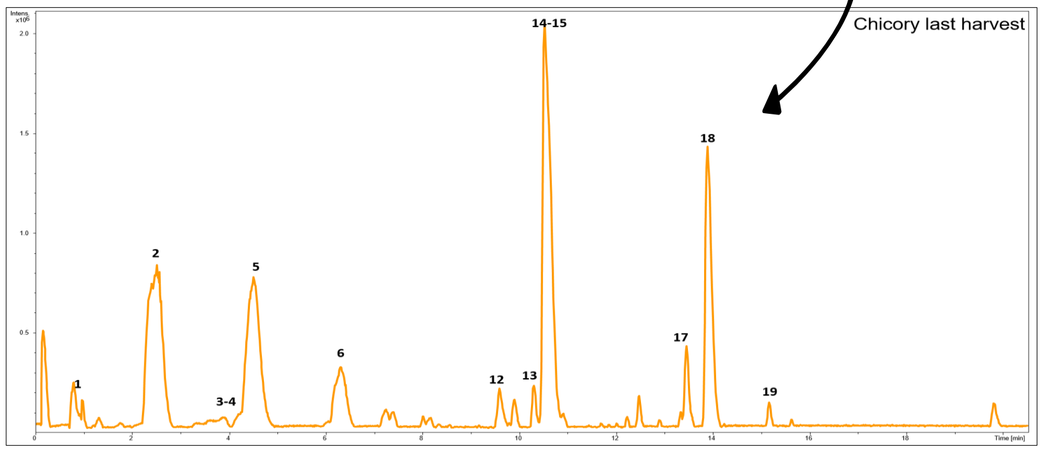
Plant families	Polyphenolic compounds
Apiaceae, Astraceae, Brassicaceae, Campanulaceae, Caprifoliaceae, Convolvulaceae, Cyperaceae , Dryopteridaceae, Equisetaceae, Fabaceae, Gentianaceae, Geraniaceae, Hypericaceae, Lamiaceae, Lythraceae, Plantaginaceae, Poaceae, Primulaceae, Rosaceae, Urticaceae	**Phenolic acids**: trans 3-O-Caffeoylquinic acid, Derivates of Caffeoylquinic acid **Flavonoids**: Luteolin, Quercetin, Apigenin **Others**: Acteoside, Malvidin, Tricin




Table 2
Main phenolic compounds in chicory

Plant families	The most abundant polyphenolic compounds
Apiaceae: Chicorium intybus	**Phenolic acids**: Chicoric acid, D-chicoric acid, Caffeic acid, Quinic acid **Flavonoids**: Kaempferol, Quercetin, Apigenin glucoronide **Coumarins**: Esculin, Chicoriin aglycon **Others**: Malic acid, Intybin

Figure 1 UV chromatogram of chicory with main compounds



RESULTS

Figure 2
Parasitological status of lambs during experiment

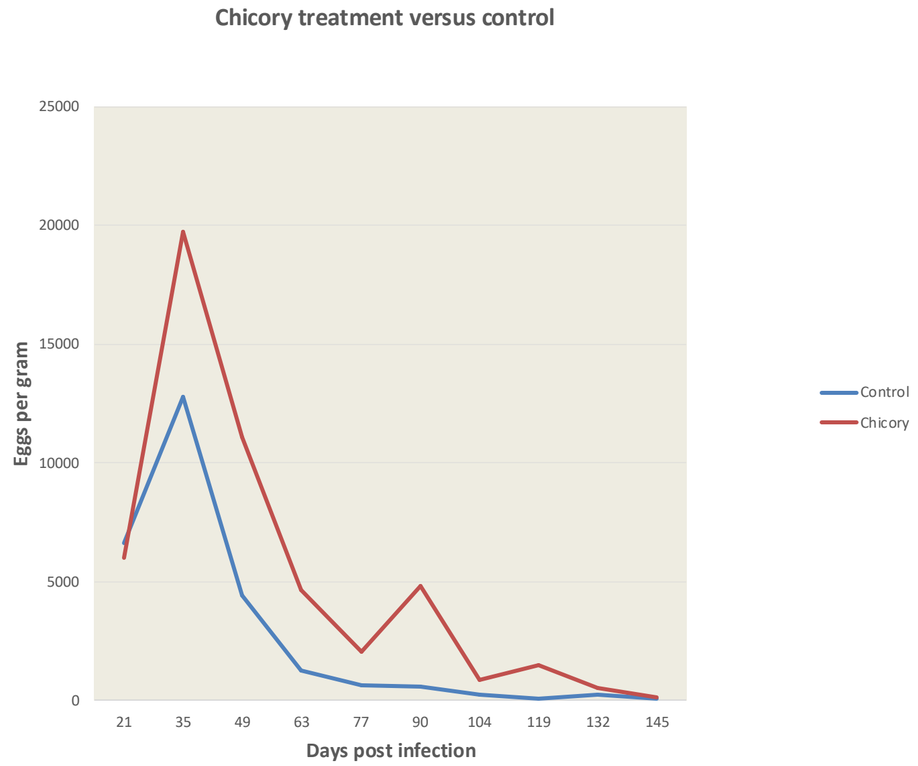


Table 3
Body weight (BW) and live-weight gain (LWG) of lambs (mean ± SD, n=8)

	Day	Control	Chicory	*P*
BW (kg)	7	13.7 ± 2.56	14.4 ± 2.56	0.567
	35	19.4 ± 2.45	20.1 ± 3.34	0.627
	63	22.3 ± 2.04	23.1 ± 3.49	0.569
	90	24.5 ± 2.12	28.2 ± 3.90	**0.029**
	132	29.1 ± 2.94	33.0 ± 4.53	**0.050**
	145	32.7 ± 3.45	38.2 ± 5.60	**0.027**
LWG (kg)	35	5.68 ± 0.93	5.66 ± 1.22	0.977
	63	2.87 ± 1.07	2.95 ± 1.01	0.871
	90	2.28 ± 1.12	5.10 ± 1.41	**0.004**
	132	4.60 ± 2.25	4.88 ± 1.38	0.769
	145	3.56 ± 1.07	5.16 ± 1.40	**0.017**

RESULTS

Table 4
Ruminal fermentation parameters of lambs (mean ± SD, n=8)

	pH	NH_3-N (mg/l)	Total SCFA (mmol/l)	SCFA (molar proportion)					
				C_2	C_3	C_4	iso C_5	C_6	iso C_7
Control	6.76 ± 0.10	170 ± 38.0	30.6 ± 8.72	67.7 ± 3.45	14.4 ± 2.40	13.4 ± 1.70	0.53 ± 0.38	1.39 ± 0.19	2.50 ± 0.67
Chicory	6.88 ± 0.21	234 ± 45.1	28.6 ± 11.9	70.1 ± 2.15	11.7 ± 1.57	12.4 ± 2.10	0.86 ± 0.22	1.62 ± 0.31	3.27 ± 0.94
P	0.147	**0.007**	0.694	0.117	**0.016**	0.326	0.053	0.076	0.067

Short chain fatty acids; C_2, acetate; C_3, propionate; C_4, *n*-butyrate; C_5, *iso*-butyrate; C_6, *n*-valerate; C_7, *iso*-valerate.

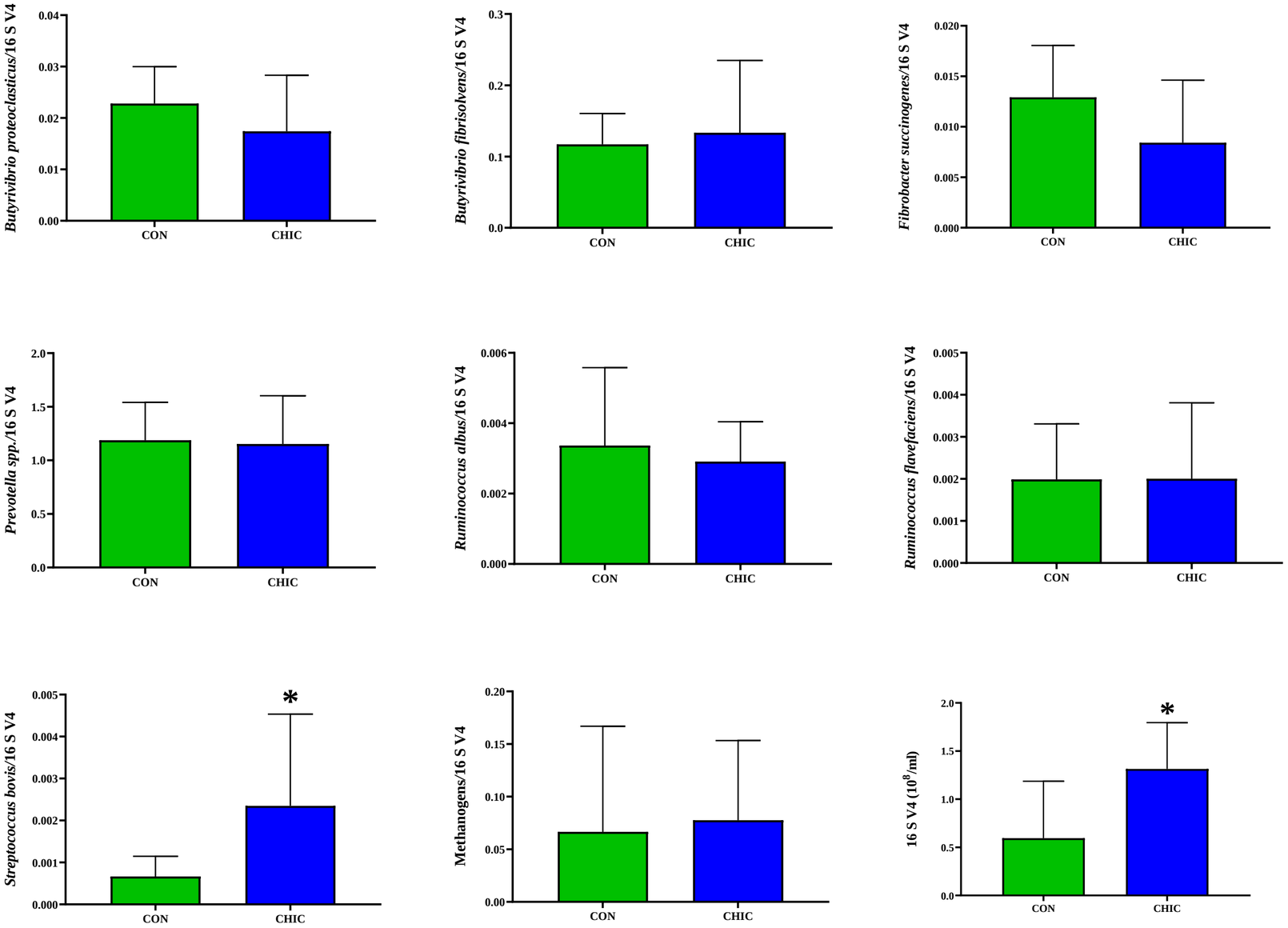
Table 5
Specific enzymatic microbial activities of lambs (mean ± SD, n=8)

Item	A-Amylase	CM-Cellulase	Xylanase	Total protozoa
	(µkat/g protein)			(n/g wRC)
Control	0.94 ± 0.787	0.78 ± 0.596	54.2 ± 13.86	332,952 ± 131,253
Chicory	1.85 ± 0.610	0.87 ± 0.708	73.6 ± 35.28	440,711 ± 146,930
P	**0.008**	0.699	**0.049**	0.167

wRC, expressed as the number per gram of wet ruminal content.

RESULTS

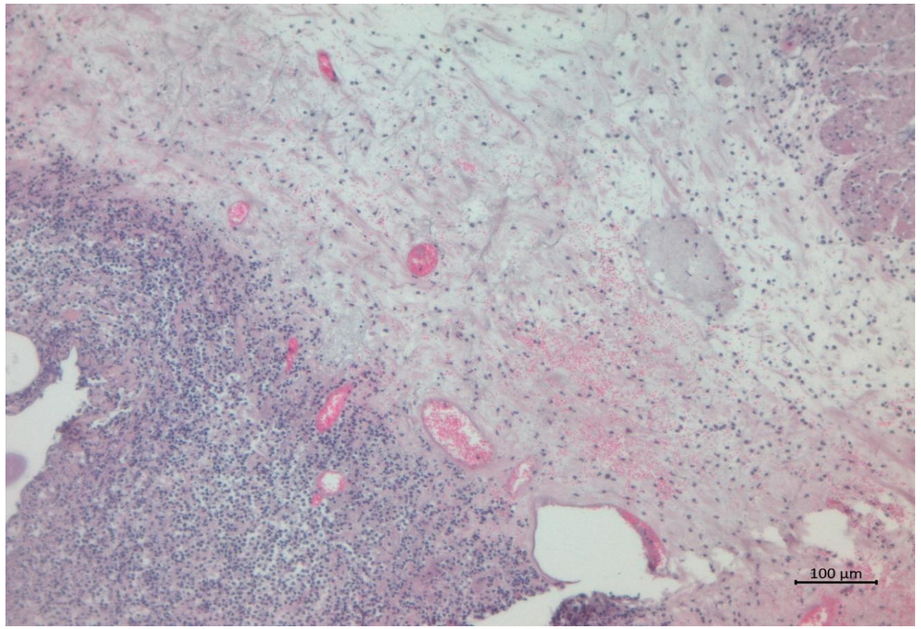
Figure 3
Relative abundance of the 16S rRNA gene (expressed relative to the total abundance of bacterial genes) of the ruminal bacterial population in Control and Chicory groups of lambs (mean ± SD, * P < 0.05).



RESULTS

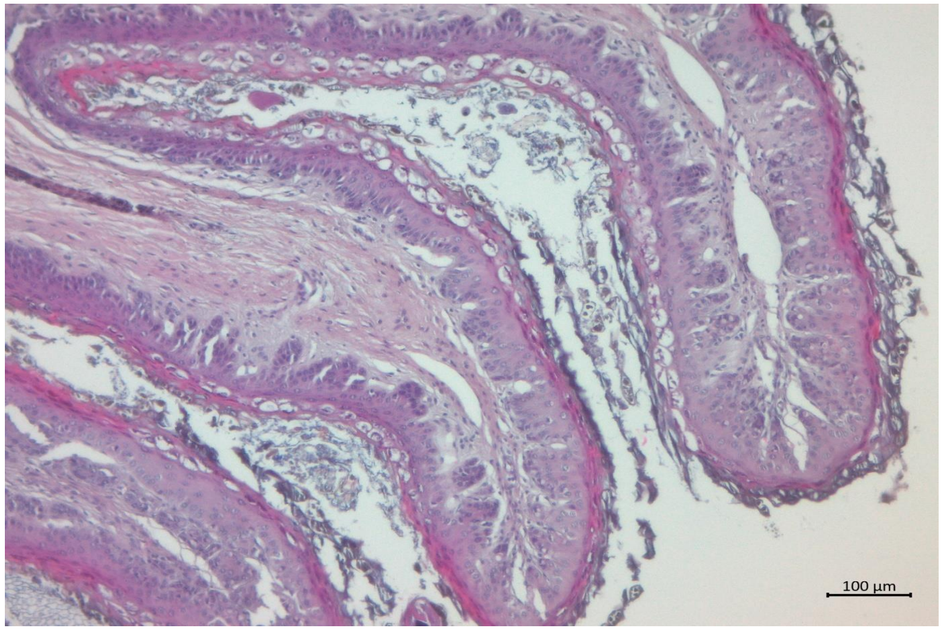
Figure 4 A,B. Histological changes of the ruminal tissue

(B) Chicory



Connective-tissue edema, inflammatory cell infiltration, hyperemia, and extravasation

(A) Control

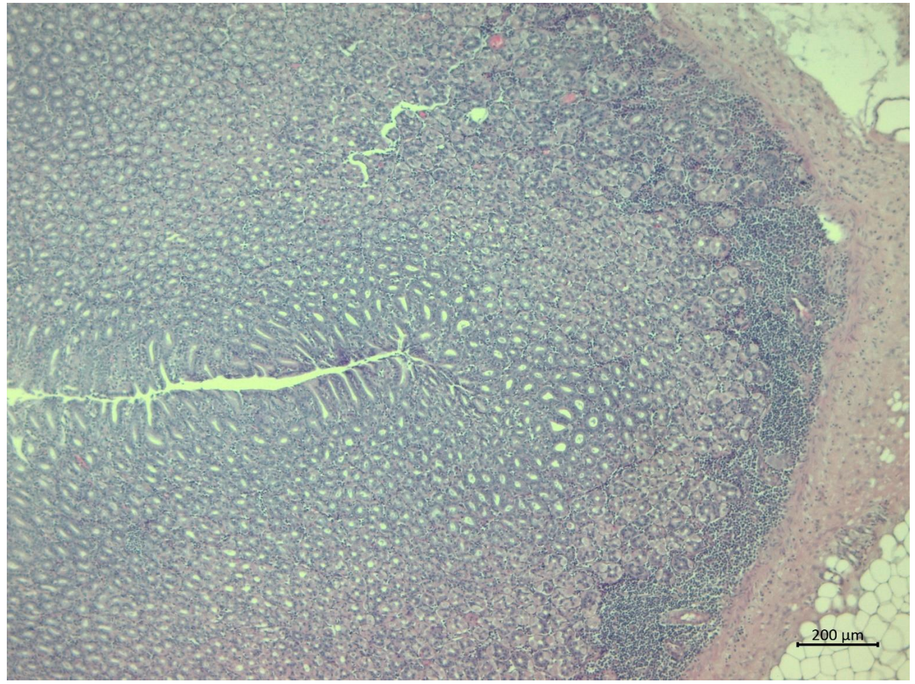


Ruminal papillae with the desquamation and ballooning of keratinocytes and *Balantidium coli*

RESULTS

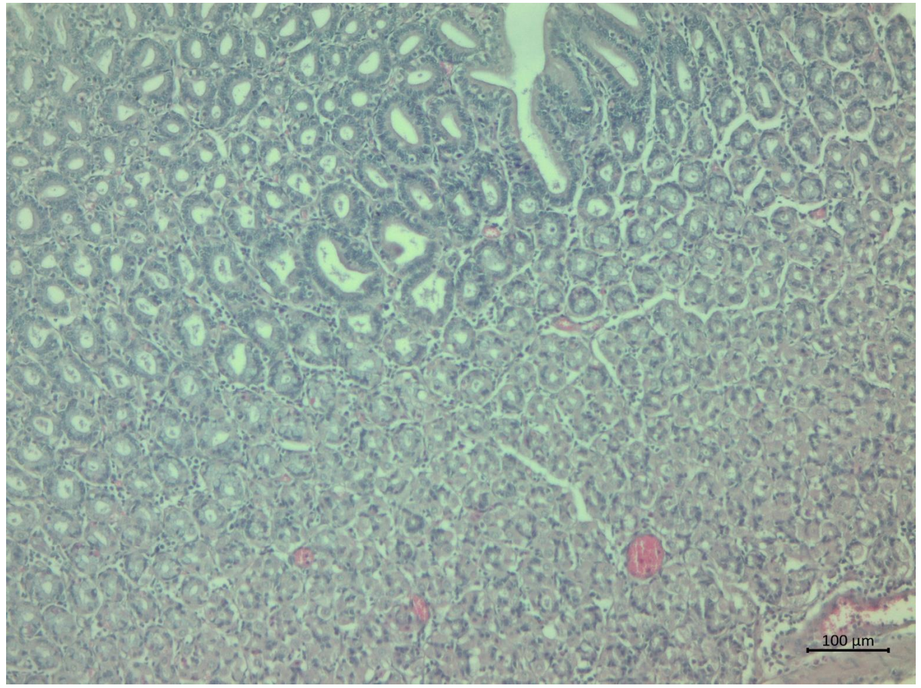
Figure 5 A,B. Histopathological sections of abomasa

(A) Control



Hypertrophy of the mucosa, lymphocyte aggregates and infiltration

(B) Chicory



Mucosal hypertrophy, mild hyperaemia, and dilatation of glands

CONCLUSION

Chicory

- Improved growth performance and parasitological status
- Improved ruminal fermentation and microbiota
- Chicory has a beneficial feeding value

Chicory is a promising alternative for the management of endoparasite compatible with the principles of organic farming


THANKS FOR
Your Attention!