Ability of condensed tannins from *Cistus ladanifer* L. to modulate *in vitro* rumen biohydrogenation

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Introduction

**Cistus ladanifer L.**

- Family: *Cistaceae*
- Genus: *Cistus*
- Specie: *Cistus ladanifer L.*

- Shrub quite abundant in marginal fields of Mediterranean countries
- Colonize degraded areas, inhibit other species’ growth and repopulates easily after wildfires (Fernández-Arroyo et al., 2010)
- All plants are covered with an exudate of aromatic gum, the *labdanum*
Introduction

Nutritionally unbalanced feed (Dentinho et al., 2005)

Anti-inflammatory activity (Barrajón-Catalán et al., 2010)

Anti-microbial activity (Greche et al., 2009)

Anti-oxidant activity (Santos et al., 2009)

Source of secondary metabolites

Terpenes
Phenols
Condensed tannins

Potential as supplement of other feeding resources and as source of bioactive compounds in a nutritional strategy to improve animal products quality
Previous works

- Incorporation of *Cistus ladanifer* in lamb diets:
  - improve oxidative stability of meat
  - improve the fatty acid profile of meat
  - without compromising production performance or sensory properties of meat

(Jerónimo *et al.*, 2011; Francisco *et al.*, 2015; Jerónimo *et al.*, 2010)
Introduction

Ruminant fat

SFA
Saturated fatty acids

PUFA
Polyunsaturated fatty acids

trans fatty acids

MUFA
Monounsaturated fatty acids

↑ risk of cardiovascular disease
Conjugated linoleic acid isomers - CLA

**Beneficial effects:**
- Anti-carcinogenic
- Anti-adipogenic
- Anti-diabetogenic
- Anti-atherogenic
- Anti-inflammatory

**Source:**
- Ruminal synthesis
- Endogenous synthesis

**Source:** (Harfoot et Hazelwood, 1997; Gruinari et al., 2000)
Incorporation of *Cistus ladanifer* in dehydrated lucerne diets supplemented with oil:

• ↑ vaccenic acid (18:1 *trans*-11) and ↓ stearic acid (18:0) production in rumen

• ↑ rumenic acid content (18:2 *cis*-9, *trans*-11) in meat

(Jerónimo *et al*., 2010)
To evaluate the effect of condensed tannins of *Cistus ladanifer* on *in vitro* ruminal biohydrogenation of C18 fatty acids
Material and Methods

Sequential extraction

Aerial part of *Cistus ladanifer*

Steam distillation (6h)

Soxhlet extraction with dichloromethane (7h)

Phenolic extraction (Acetone 70%; solid:liquid ratio 1:5; 2h)

Purification with chromatographic column Sephadex LH-20

Condensed tannins (CT)
Material and Methods

**in vitro incubations**

**Substrate:**

- Dehydrated alfalfa based (70%) supplemented with 6% sunflower oil - C
- 10% Condensed tannins - CT

Ruminal fluid + McDougall’s buffer solution (1:2) (McDougall, 1948)

Incubated at 39°C for 6h
Material and Methods

Volatile fatty acids

Fatty acid methyl esters (FAME) – Transesterification protocol (Alves et al., 2013)

5 incubation runs (n=5)

PROC MIXED (SAS) – incubation run as random block (Complete Randomized Block Design)
Results

Volatile fatty acids production – without variation between CT and control

Biohydrogenation of C18 FA

18:2 n-6

18:3 n-3

% of biohydrogenation

C
CT

C
CT
Results

18:2 cis-9, trans-11

- Linoleic acid
- Rumenic acid
- Vaccenic acid
- Stearic acid

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Results

18:0

18:2 cis-9, cis-12
Linoleic acid

18:3 cis-9, cis-12, cis-15
Linolenic acid

18:2 cis-9, trans-11
Rumenic acid

18:1 trans-11
Vaccenic acid

18:0
Stearic acid

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Conclusions

**Condensed tannins** of *Cistus ladanifer* induced changes on *in vitro* biohydrogenation

Higher biohydrogenation of C18 PUFA

Higher accumulation of **rumenic acid** and **vaccenic acid**

**Stearic acid** accumulation

18:2 *cis*-9, *cis*-12 (linoleic acid)

18:2 *cis*-9, *trans*-11 (rumenic acid)

18:1 *trans*-11 (vaccenic acid)

18:0 (Stearic acid)
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