

TANNINS: AN ANTHELMINTIC ALTERNATIVE FOR HERBIVORES

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Is there a plausible **alternative to common anthelmintics**, which are becoming less effective to fight against parasites?

HYPOTHESIS

Tannins have **suppression effects on parasites** in herbivores

INTRODUCTION

Secondary metabolites perform **non-essential functions** but they can promote **adaptation to unfavourable environments** and under **stressful conditions**, such as high temperatures, light or water stress and poor soil quality, which regulate the **phenological** development of the plant, thus increasing the **synthesis of tannins**

TANNINS

Present in trees, shrubs and herbaceous plants. They are a **heterogeneous** group of **phenolic compounds** with high molecular weight which are able to bind proteins, polysaccharides, alkaloids, nucleic acids and some minerals



Underfed Hereford cow

PATHOLOGY OF NEMATODES IN HERBIVORES

Reduction of **food intake**, **absorption** and **retention of minerals** (especially phosphorus), causing significant **losses in protein absorption** and **hormonal changes** that disrupt the normal functioning of the digestive system

HYDROLYSABLE TANNINS (HT)

Formed by **carbonilic core (D-glucose)** linked to **phenolic groups** such as Gallic or Ellagic acid .

These compounds metabolized by *Eubacterium oxidoreducens*, *Streptococcus bovis*, *Syntrophococcus sucrommutans* and *Coproccoccus spp* form **pyrogallol**, which is **toxic** for herbivores

CONDENSED TANNINS (CT)

Non-branched polymers of **flavonoids** such as 3-flavanols (**catechin** or **epicatechin**), precursors of procyanidins and epigallocatecina, which can condense to form prodelphinidinas

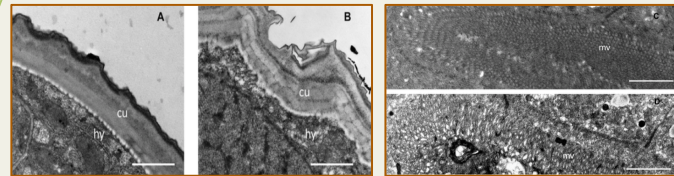
Affecting

PATHOGEN

The CT damage **external tissues** such as the **cuticle** and **hypodermis**, and **internal tissues** like the **microvilli** in intestinal tissue



Light microscopy of *A. suum* larvae (Williams et al., 2014).



Ultrastructural changes in *Ascaris suum* L4 exposed to condensed tannins (B and D) (Williams et al., 2014)

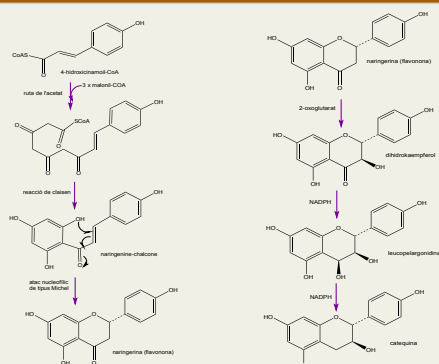
HERBIVORES

High concentrations of CT reduce voluntary feed intake in animals, explained by three factors: **decreased taste**, **slowing digestion** and **conditioned aversion**.

Moderate concentrations of CT increase protein absorption in abomasum due to a decrease in ruminal degradation

SELF-MEDICATION OF HERBIVORES

Herbivores show self-medication prophylactic and therapeutic behaviours. There are some studies by Lisonbee et al. (2009) or Villalba et al., (2014) demonstrating these behaviours in goats, sheep and cows



Mixed shikimic and acetate metabolic pathways to form catechin

CONCLUSIONS

CT are a useful potential **alternative anthelmintic** in herbivores considering the recent appearance of resistance to conventional anthelmintics.

Animals treated with condensed tannins **reduce the population of nematodes** and their **reproduction**. This effect is produced by acting on the **cuticle** and **hypodermis larvae**, as well as the effect on **microvilli**, causing intestinal damage in these parasites.

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