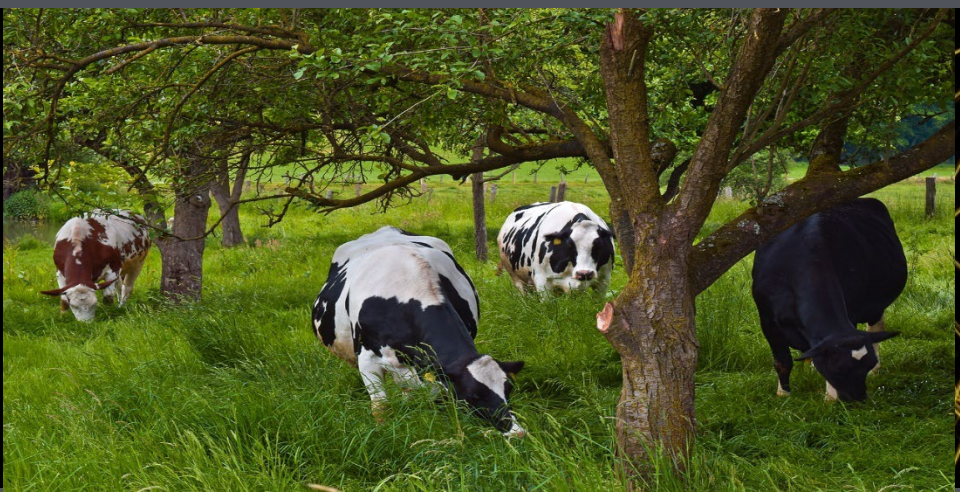


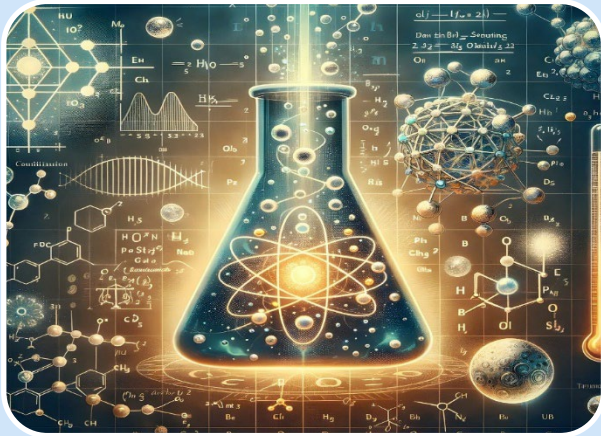
Effects of goat willow's tannin profile on *in vitro* methane production and rumen fermentation



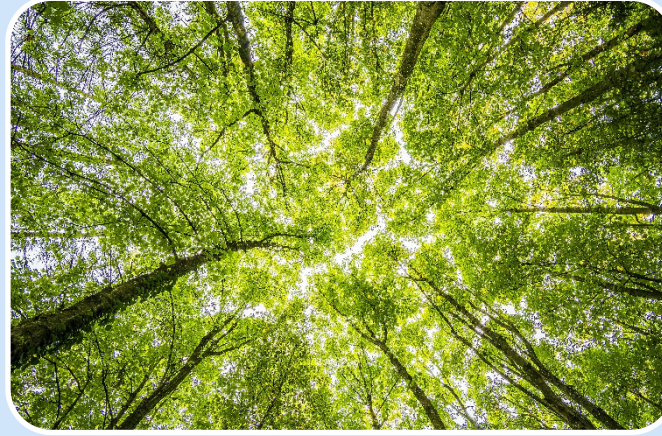
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INTRODUCTION



Tree fodder provides a cheap and readily available source of proteins for grazing animals as they contain between 10 and 30% crude protein on a dry matter basis



Previous work has shown total condensed tannin and their profile (PC, PD, *cis*, *trans*, mDP) in three tree species (goat willow; oak; field maple), plant fraction and months via a field trial



Research is lacking concerning the effect of condensed tannin profiles (high concentrations of PC, HPC; high concentrations of PD) on CH₄ production

OBJECTIVES OF THE STUDY



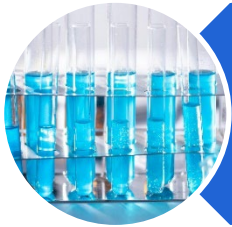
Investigate the effect of condensed tannin profiles (high concentrations of PC, HPC; high concentrations of PD, HPD) on gas and CH₄ production, via an *in vitro* gas production system.



Experimental Design



For each incubation time, each sample of the two substrates <2 mm (GW with high procyanidin and GW with high prodelphinidin) with and without PEG was weighed 0.2 g, then was added to 0.8 g dried, milled (< 2 mm) grass silage substrate in Wheaton flasks.



Grass silage-only flasks and negative control flasks (no grass silage substrate) were also prepared.



To each flask 90 ml buffer and 10 ml rumen fluid obtained from a dry dairy cow at the Centre for Dairy Research (strained through two layers of cheesecloth) was added, after which the flasks were sealed and incubated at 39°C.



At 2, 4, 6, 8, 10, 12, 24, 32, 48 and 72 h, the gas pressure was recorded, and a sample of gas was removed for CH₄ analysis.

- pH, DMd, Gas and CH₄ production, VFA analysis

Sample analysis



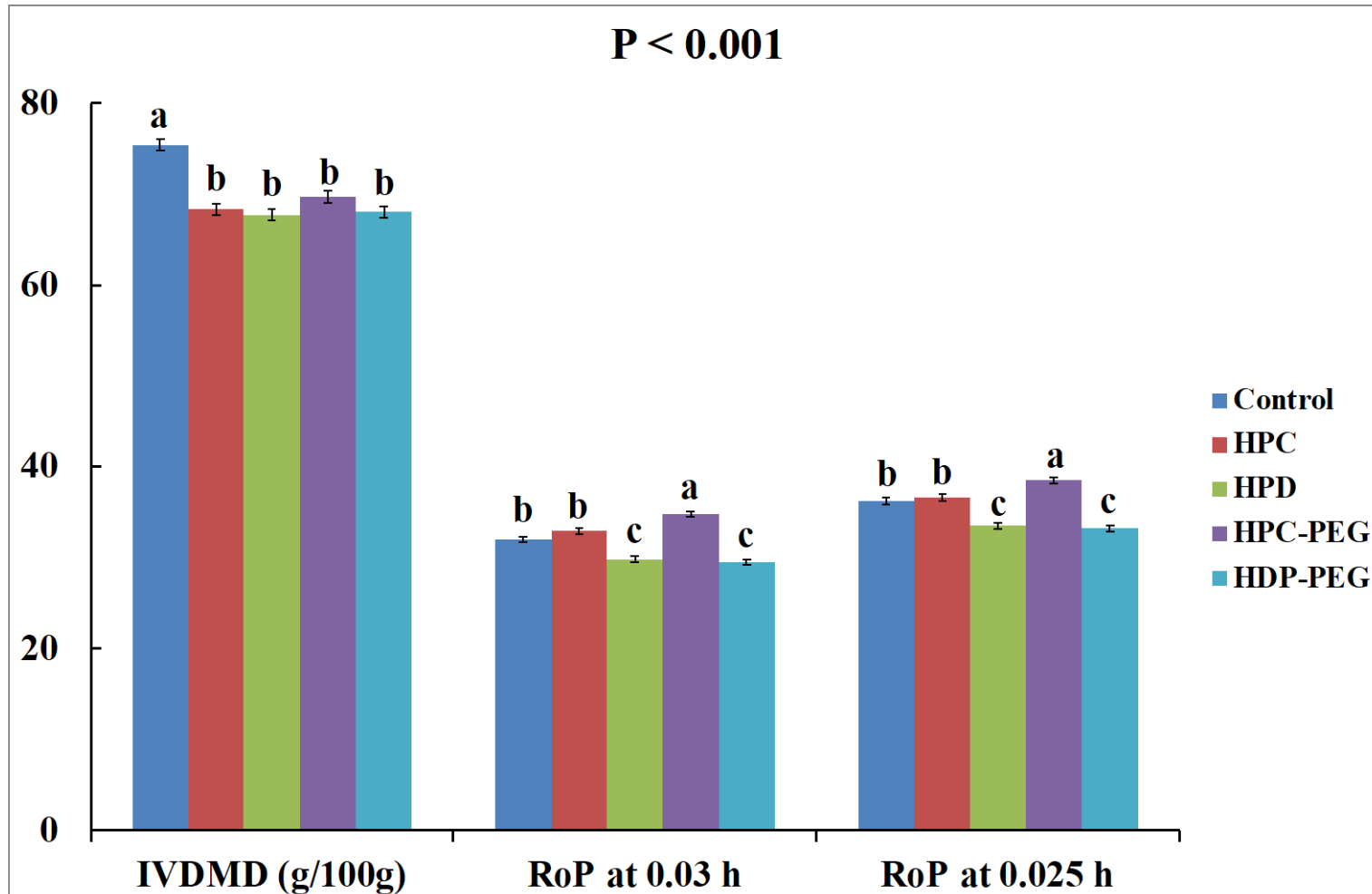
- Mixed linear effects model (Minitab 20.2)
 - Fixed factor: treatment (control, high-procyanidin, high-prodelphinidin, high-procyanidin plus PEG, high-prodelphinidin plus PEG)
 - Random factor: batch run

Statistical analysis



RESULTS

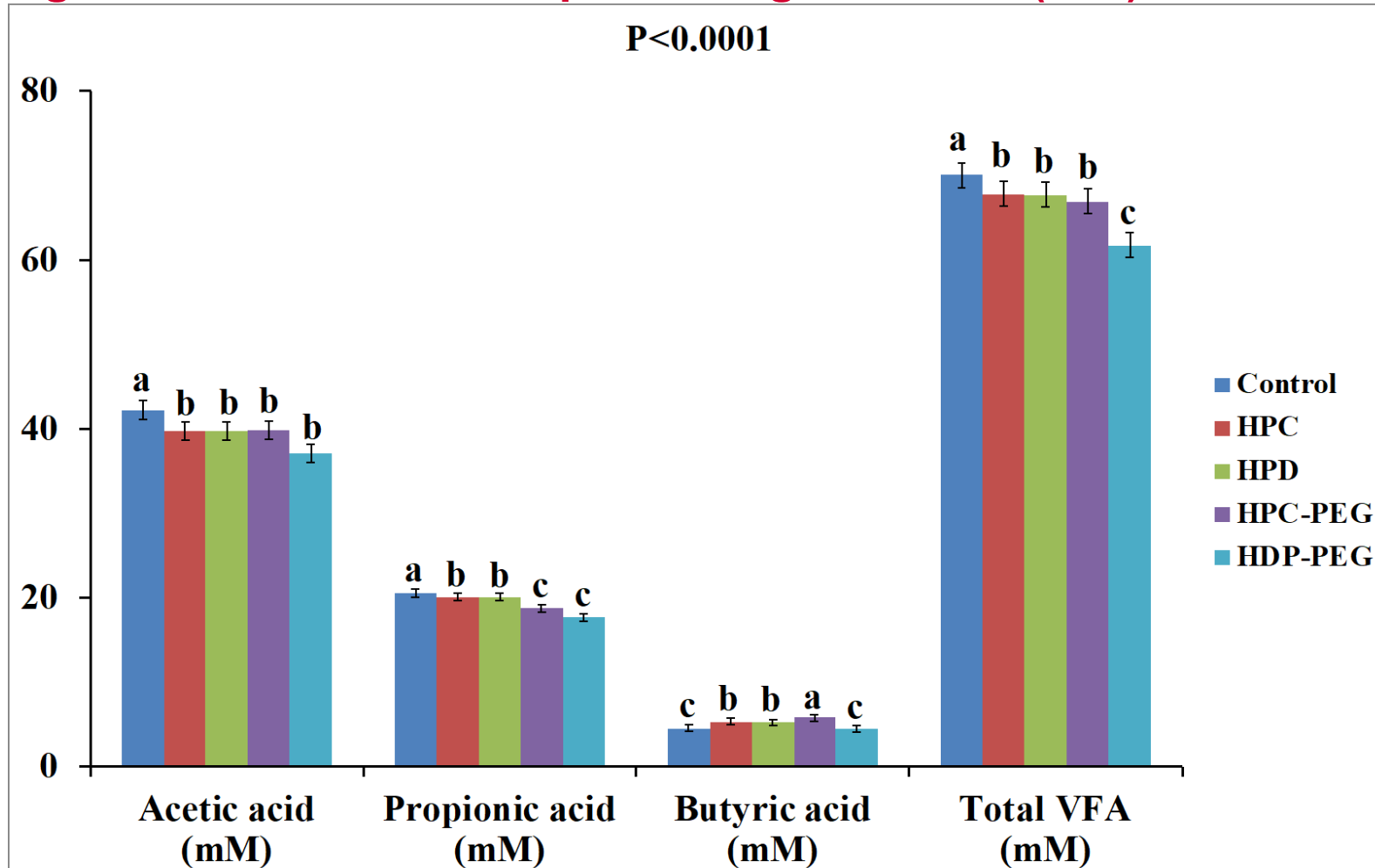
Figure 1. Effect of tannin profile in goat willow (GW) on in vitro dry matter digestibility (IVDMD)



➤ When compared with the four treatments (HPC, HPD, HPC-PEG, HPD-PEG), Control had higher IVDMD

RESULTS

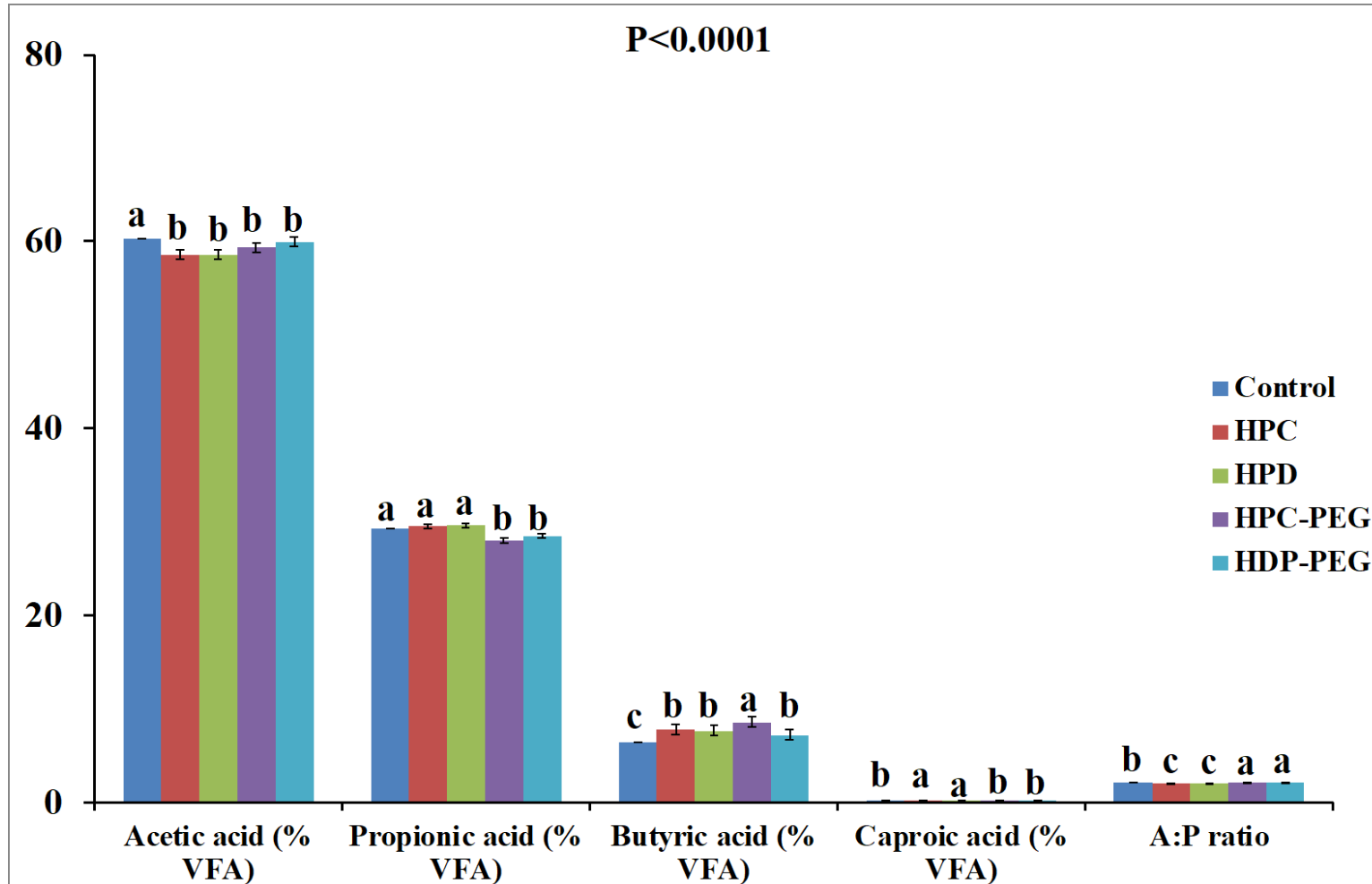
Figure 2. Effect of tannin profile in goat willow (GW) on *in vitro* rumen fermentation parameter



- HPC, HPD, HPC-PEG, HPD-PEG, had higher concentrations of acetic acid than CONTROL.
- Concentrations of propionic acid were lower for HPC and HPD as well as HPC-PEG and HPD-PEG than CONTROL.
- The PEG containing treatments (HPC-PEG, HPD-PEG) also had lower concentrations of propionic acid than their corresponding treatments without PEG.

RESULTS

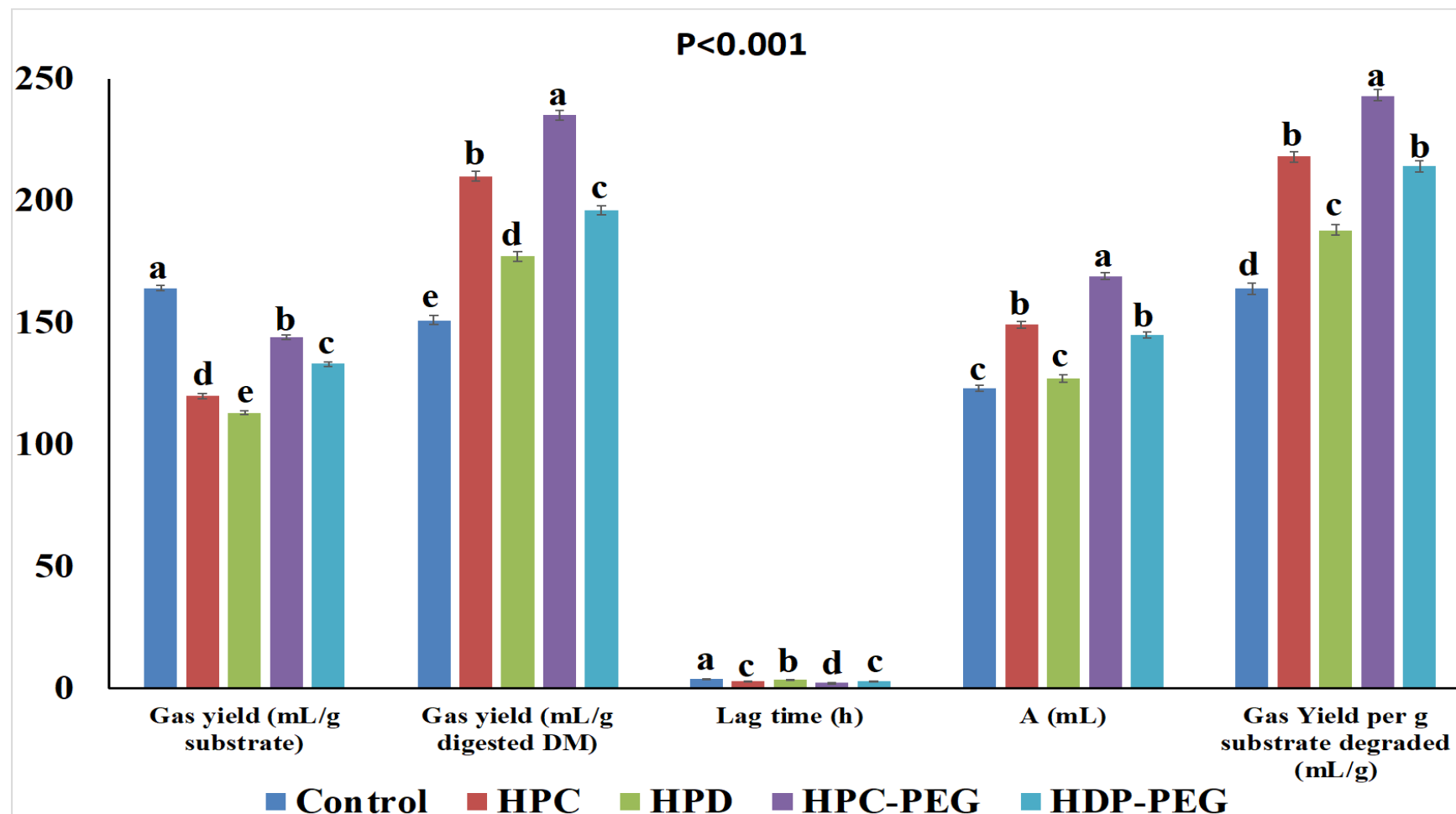
Figure 3. Effect of tannin profile in goat willow (GW) on *in vitro* rumen fermentation parameter (% VFA)



- When propionic acid was expressed as % VFA, there was no difference between Control, HPC and HPD, whilst there was a reduction in the concentrations of HPC-PEG and HPD-PEG.
- HPC and HPD had significantly more caproic acid compared with Control, HPC-PEG, and HPD-PEG.

RESULTS

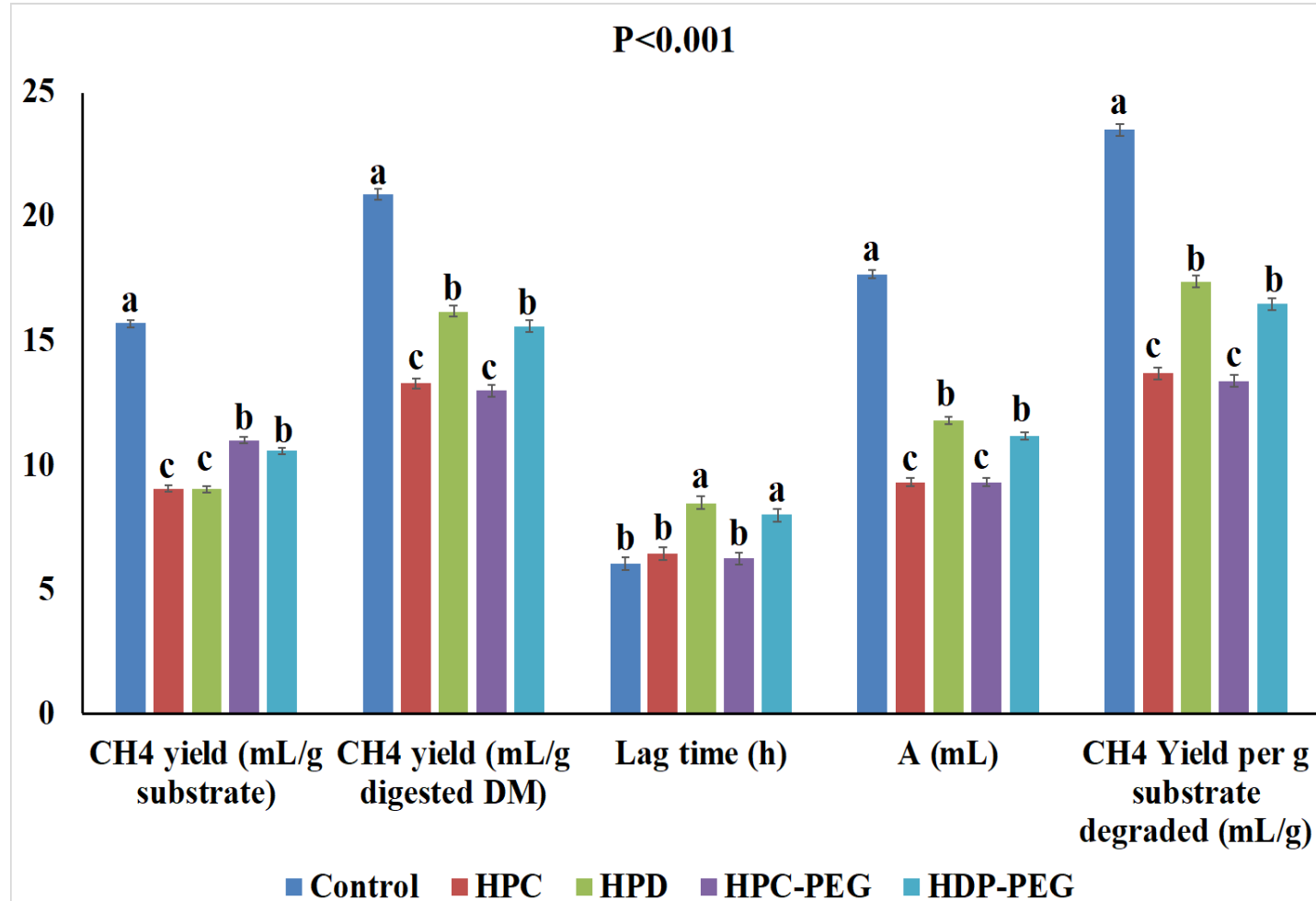
Figure 4. Effect of tannin profile in goat willow (GW) on *in vitro* gas production



- When compared with Control, treatments HPC, HPD, HPC-PEG, and HPD-PEG had lower gas yield when expressed as mL/g substrate.
- HPC and HPD had lower gas yields compared with HPC-PEG and HPD-PEG, whilst HPD and HPD-PEG had lower gas yields than HPC and HPC-PEG.
- When compared with Control, treatments HPC, HPD, HPC-PEG, and HPD-PEG had higher gas yield when expressed as mL/g digested DM
- HPC and HPD had lower gas yields compared with HPC-PEG and HPD-PEG, whilst HPD and HPD-PEG had lower gas yields than HPC and HPC-PEG.

RESULTS

Figure 5. Effect of tannin profile in goat willow (GW) on *in vitro* CH₄ production



- HPC, HPD, HPC-PEG and HPD-PEG had lower CH₄ yield than CONTROL, when expressed as mL/g substrate.
- HPC and HPD had lower gas yield compared with HPC-PEG and HPD-PEG, whilst there was no difference between HPC and HPD, or HPC-PEG and HPD-PEG.
- HPC, HPD, HPC-PEG, and HPD-PEG had lower CH₄ yield than CONTROL when expressed as mL/g digested DM
- HPC and HPC-PEG had lower CH₄ yield compared with HPD and HPD-PEG, whilst HPC and HPD were not statistically different to HPC-PEG and HPD-PEG respectively.

CONCLUSION



The present study demonstrates that as CH₄ mitigators, both High-PC and High-PD tree fodder reduced CH₄ emissions by up to 42% per g DM, or up to 36% per g digested DM, in an *in vitro* model, with High-PC showing a stronger effect.



This effect was partly due to condensed tannins (e.g. CH₄ reduction was observed even when tannins were neutralised with polyethylene glycol) but also due to the reduced degradability of tree fodder than the grass silage that replaced in the diet.



The findings highlight the potential tannin-containing tree fodder can play in feeding regimes for sustainable livestock feeding practices, whilst comprehensive tannin profiling and subsequent dietary adjustments are essential to maximising the potential beneficial impact.

ACKNOWLEDGEMENTS

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MANY THANKS FOR YOUR ATTENTION

QUESTIONS ARE WELCOME
