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Camelina sativa L. Cake Reduces Enteric Methane Emissions in Polish Holstein Friesian Heifers by Suppressing Methanogen Activity Without Compromising Digestibility

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Introduction

- **Renewed interest: an oil plant with minimal cultivation requirements and tolerance to water shortage**
- **Cake, by-product**

Ibrahim and Habbasha 2015; Paula et al 2019

Alternative plant feed resources

- Increase the sustainability of animal production

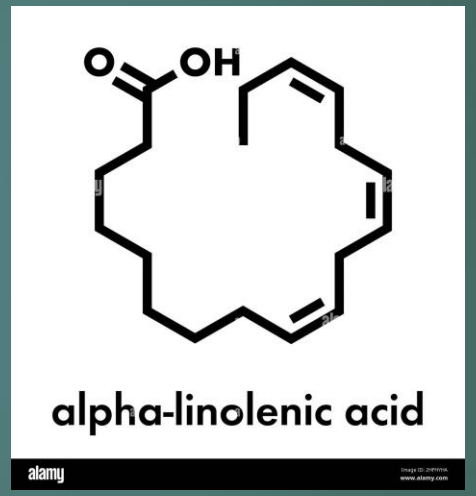
- Increase efficiency of feed for ruminants

- Reduce environmental burdens

Giamouri et al., 2023; Meli et al., 2023

Introduction

- Methane (CH_4) emissions from ruminants - critical issue in livestock production
- Valuable feed ingredient that can support animal health and improve energy utilization in ruminants
- Rich source of alpha-linolenic acid

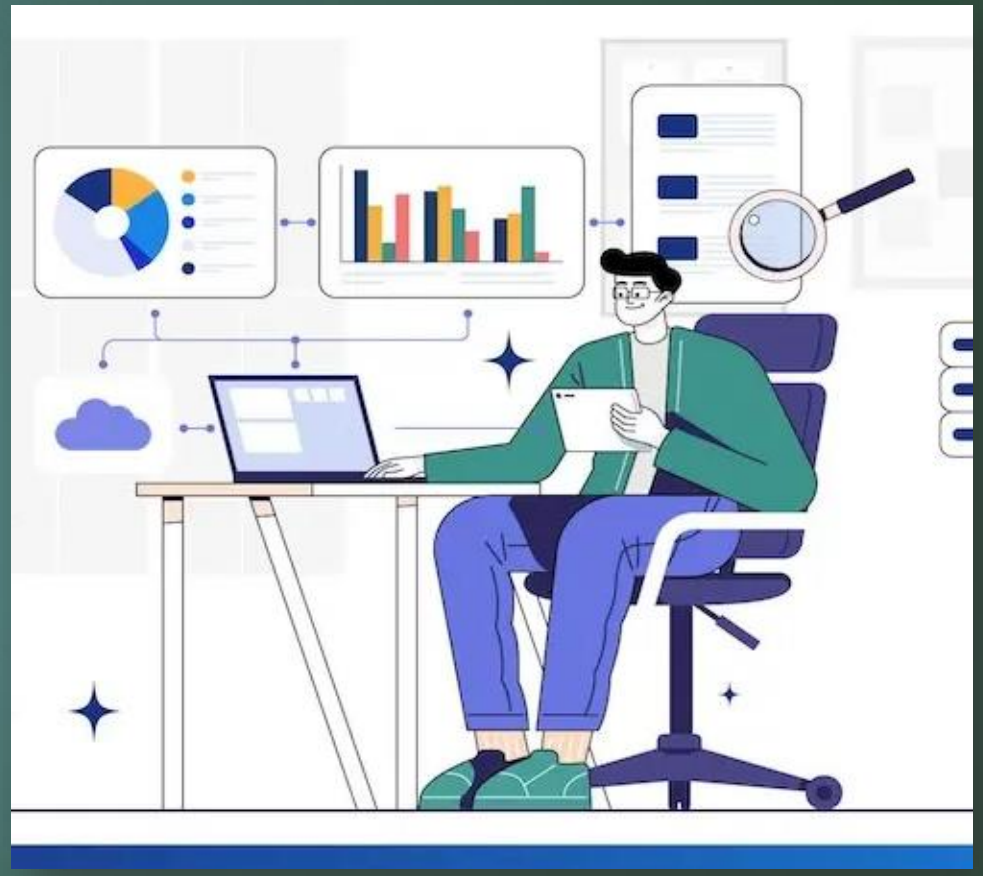


(Bayat et al., 2015; Riaz et al., 2022)

Hypothesis

Camelina sativa L. cake:

- Rich source of C18:3 n-3;
- Valuable dietary component mitigating enteric methane emission and ammonia production;
- No negative impact on dry matter intake, and ruminal fermentation.



The goal

- To evaluate the effect of *Camelina sativa* L. cake, a source of C18:3 n-3, on enteric methane and ammonia emission, dry matter intake, and ruminal fermentation.

Materials & Methods

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- Eight Polish Holstein-Friesian heifers (369 ± 31 kg body weight);
- Two groups: control and experimental; n=4;
- CON – Rapeseed meal
- EXP – *Camelina sativa* L. cake

Materials & Methods

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Item (g/kg DM)	Control	Experimental
Grass silage	388	388
Maize silage	206	206
Beet pulp	119	119
Rapeseed meal	133	133
Meadow hay	119	119
Mineral blend	35	35

\+ 1 kg rapeseed meal 1 kg *Camelina sativa* cake

Materials & Methods

Fatty acids (g/100g FA)	Control	Experimental
C16:0	17.4	12.3
C18:0	5.89	5.76
C18:1cis 9	24.7	21.1
C18:2c9c12	38.7	33.7
C18:3c9c12c15	7.99	19.2

Materials & Methods

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- Crossover design;
- 26-d experiment (21 d aptation +5 d sampling period;
- Four respiration chambers (SPA system, Ltd., Wroclaw, Poland).

Materials & Methods

- Individual dry matter intake;
- Rumen fluid collection by stomach tubing (Ruminator, Profs Products, Wittybreut, Germany).

Materials & Methods

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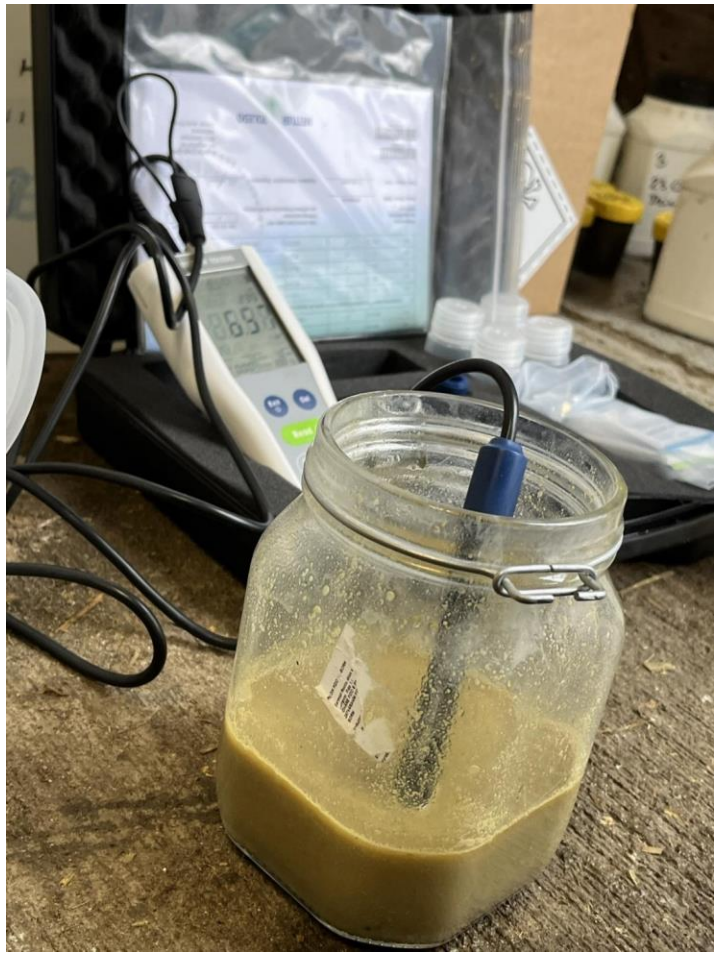


- pH;
- Ammonia and VFA concentration;
- Rumen microbial community analysis;
- Fatty acids profile;
- Microbial characteristics;
- Data analysis: Rstudio Version 2022, One-way ANOVA, Student's t-test

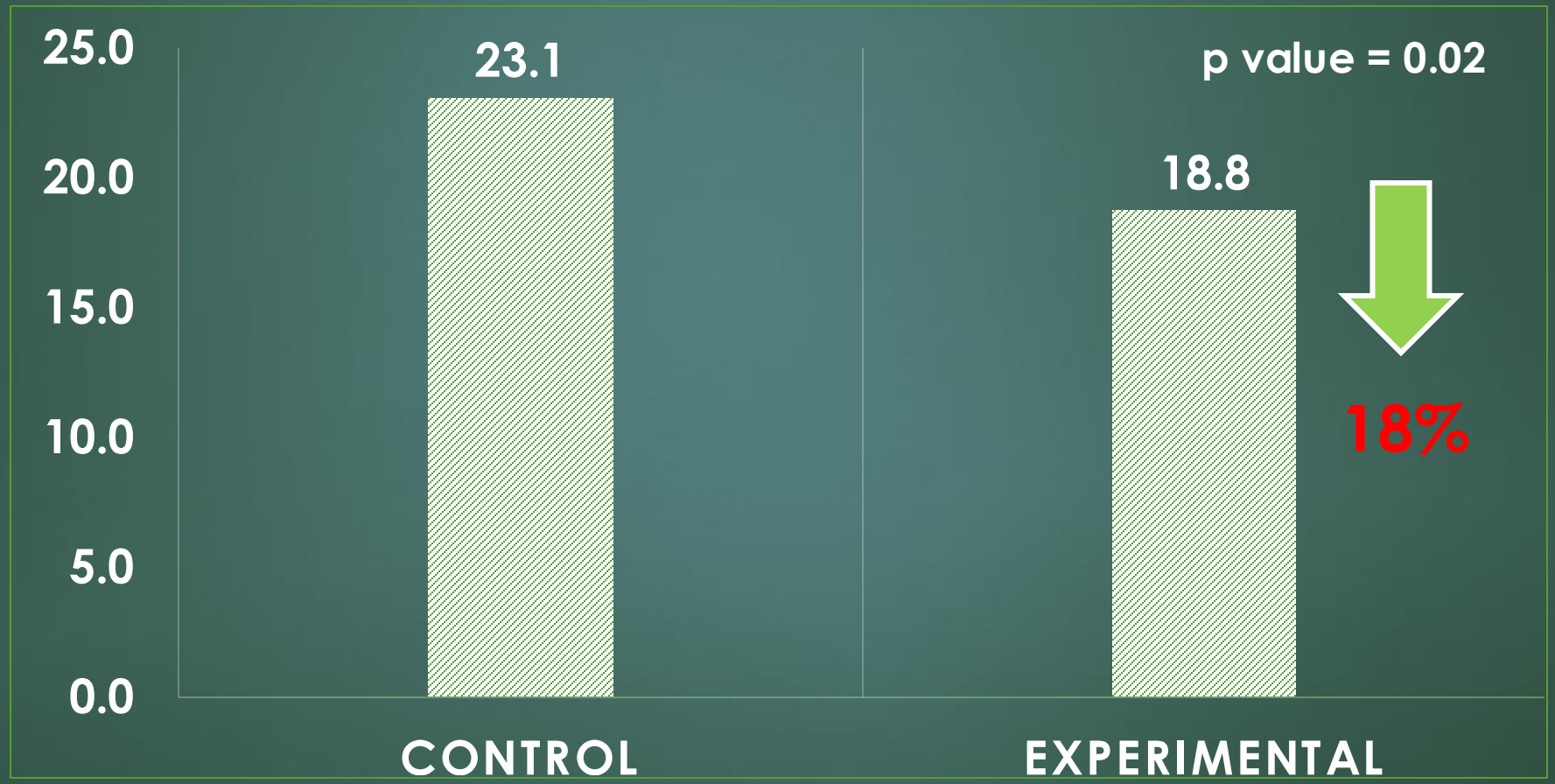
Results

Rumen fluid parameters and protozoa counts

Items	Control	Experimental	SEM	P_value
Total VFA, mM	86.4	93.9	1.404	0.054
Propionate, mM	**16.9**	**21.0** ↑ 24%	**1.059**	**0.001**
Iso-valerate, mM	**1.68**	**1.88** ↑ 11%	**6.761**	**0.044**
Acetate/Propionate ratio	**3.49**	**2.91** ↓ 17%	**7.161**	**0.001**

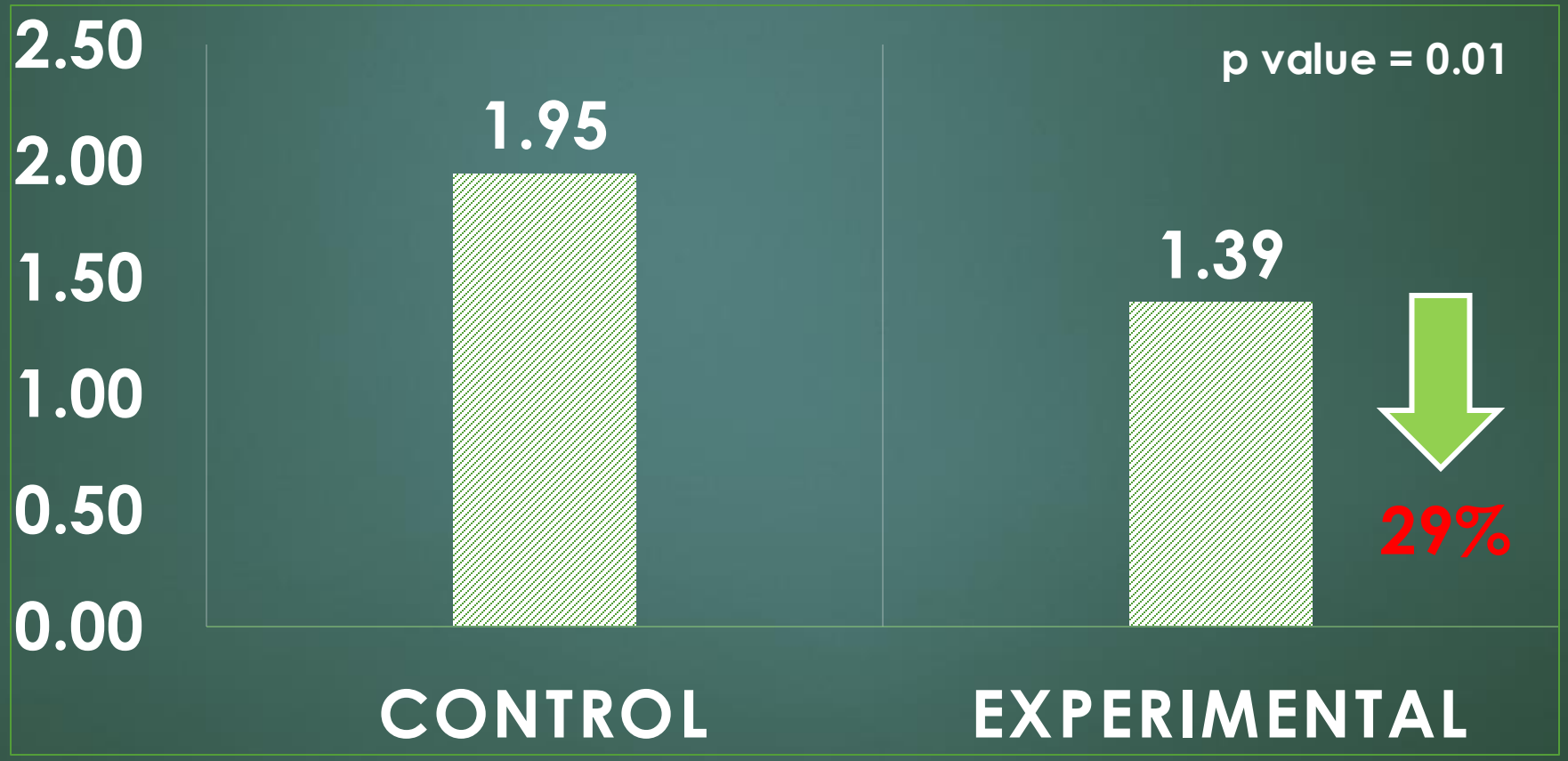
Results

Methane emission (g/kg DMI)



Results

Ammonia concentration g/kg DMI

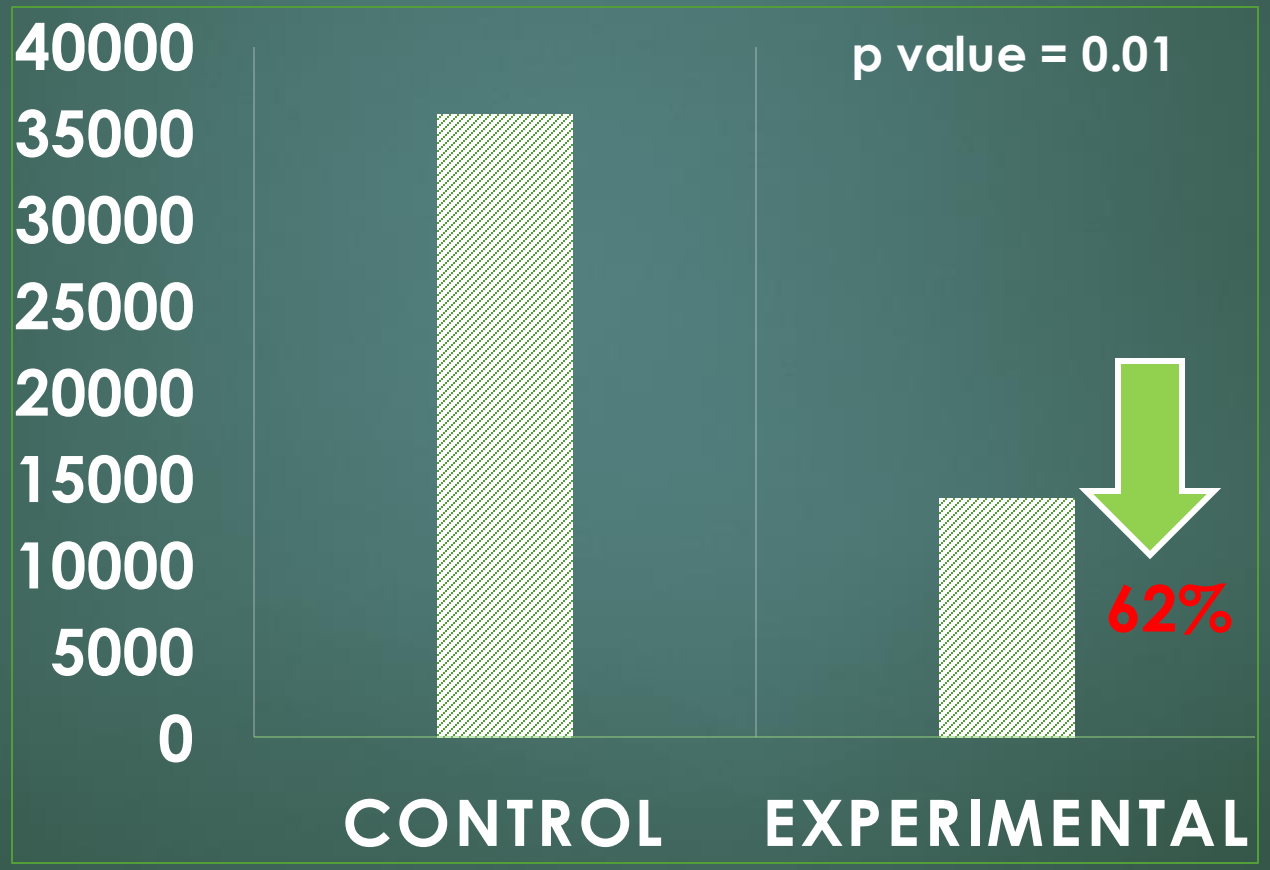


Results

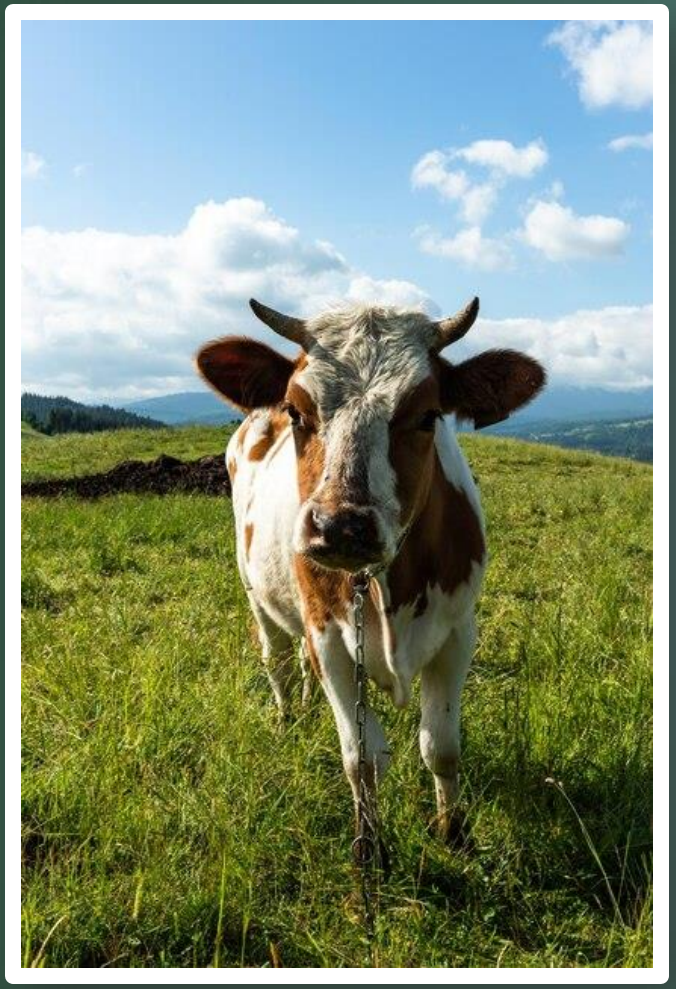
Dry matter intake (g/day)

Results

mcrA gene (copy number)



Conclusion



- Addition of 1kg/day of *Camelina sativa* L. cake to the heifer's diet caused mitigation of enteric methane emissions and ammonia concentration without a negative impact on dry matter intake and ruminal fermentation, which confirms the hipothesis
- Thus, Camelina sativa L. cake as a rich source of C18:3 n-3 is a valuable dietary component.

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Thank you for your attention!