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Fermented rapeseed cake in dairy cows' nutrition mitigates methane emission and production

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Introduction



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Rapeseed:

- global production - 82.5 million tons in 2022
- 38 million tones - produced as by-products
- good source of protein ~ 35%
- good source of fat ~ 10%

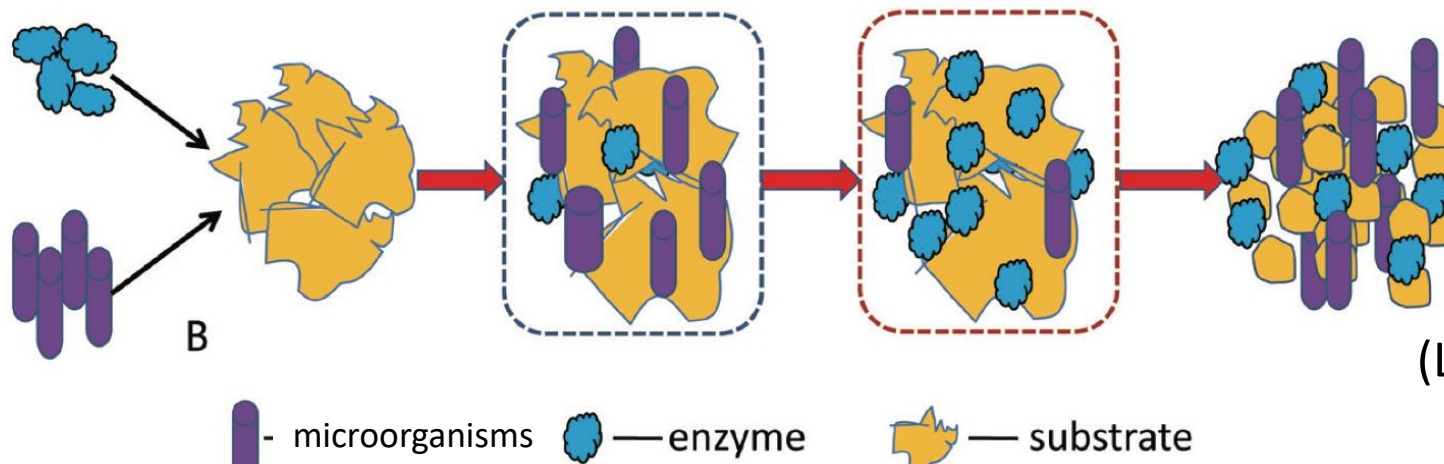


(USDA, 2022)

Introduction

The solid-state fermentation technology can:

- degrade plant lignin and cellulose
- reduce glucosinolate level
- improve protein content



(Li et al., 2021)



Introduction



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Fermented sources of protein can:

- change the number/proportions of microorganisms
- favour increased propionate production
- decrease methane emission?

(Wang et al., 2021)



Hypothesis



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Fermented Rapeseed Cake (FRC)
as an alternative for rapeseed cake (RC)
in dairy cows' diets
modulates ruminal fermentation
and decreases CH₄ emission.



Aim



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To evaluate the impact of FRC on ruminal fermentation,

CH₄ emission, and milk production in lactating dairy

COWS.



Material and Methods



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Item	RC ¹	FRC ²
Chemical composition, g/kg DM		
Organic matter	931	930
Ash	69	70
Crude protein	361	386
Neutral detergent fiber	248	271
Ether extract	103	95

¹RC - rapeseed cake

²FRC - fermented rapeseed cake (patent-pending procedure No. 422849)

Material and Methods

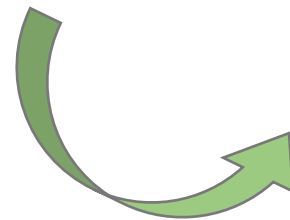


RC vs. FRC

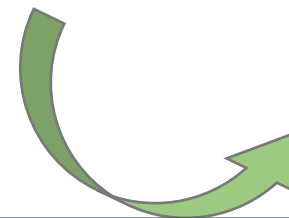


RC vs. FRC

28.75 (FRC25), 57.5 (FRC50), 86.25 (FRC75), and 115 (FRC100) g/kg diet of FRC

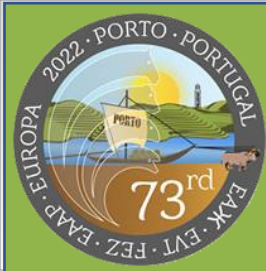


RC vs. FRC (115 g/kg diet = 2.65 kg/day)



RC vs. FRC (115 g/kg diet = 2.65 kg/day)





Material and Methods



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Diet composition	g/kg of DM
Maize silage	354
Lucerne silage	88
Grass silage	83
Beet pulp	111
Brewer's grain	111
Barley/wheat grain	97
Concentrate	31
Mineral-vitamin mixture	10
RC/FRC	115

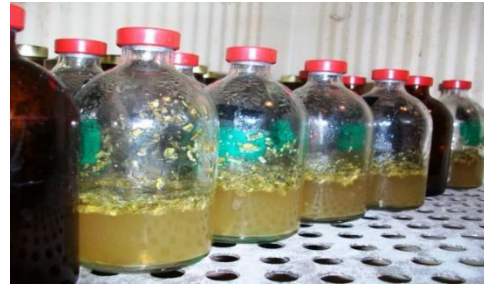
Material and Methods



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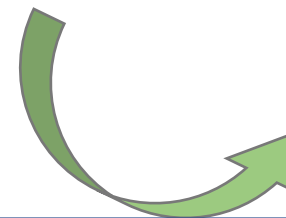
RC vs. FRC



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RC vs. FRC (115 g/kg diet = 2.65 kg/day)



Results – *in vitro*

pH, propionate



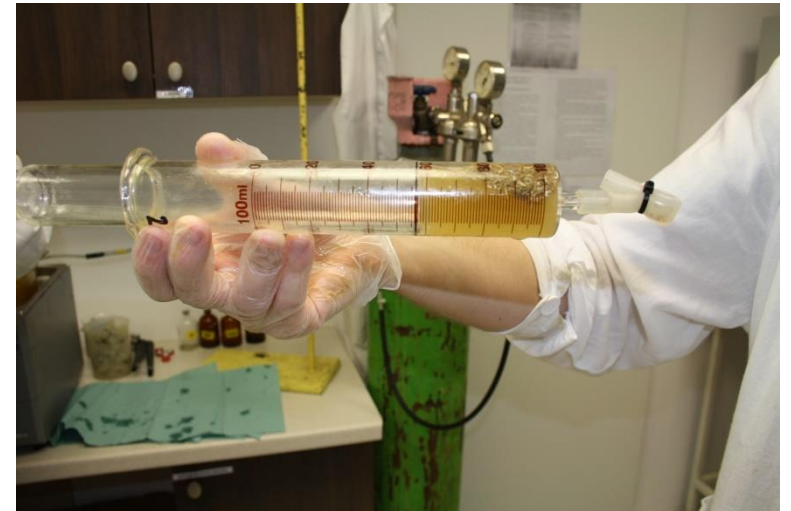
Digestion



Methane production



Methanogens population





Results – *in vivo*



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pH



6.16 vs. 6.04

propionate



22%

Digestion



Methane emission



17%

Methanogens population



34%





Results – *in vivo*



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Milk yield



Milk composition



Methane concentration



11%





Conclusions



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2.65 kg dietary FRC per day per cow
can effectively mitigate rumen methane
emission by 11-17%

reducing the methanogens population by 34%
and increasing propionic acid concentration.

