In vitro effects of medium-chain fatty acids on methanogenesis from rumen inoculum of kids supplemented or not with coconut oil in early life

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Lipid Course, Ghent.

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Introduction

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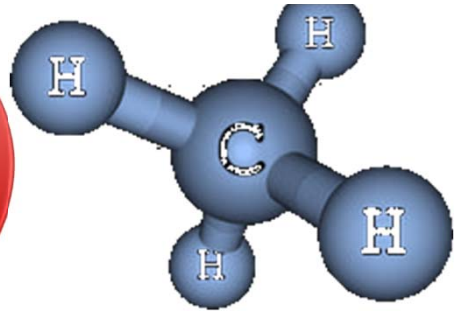
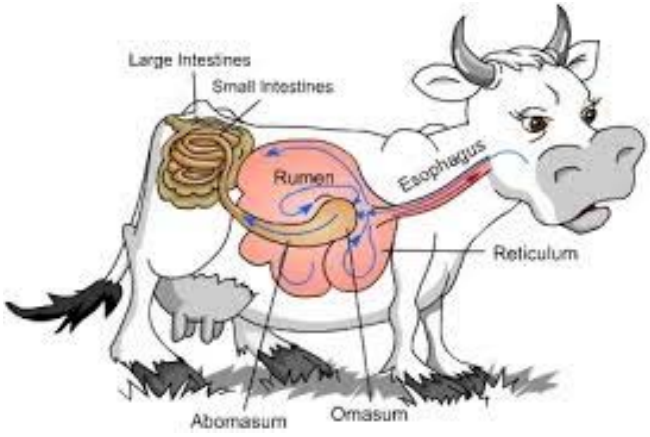
Methane (CH_4)





Microbial fermentation

Cattle: 75 Mt

Small ruminants: 9 Mt

Global warming

Dietary energy losses

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Several CH_4 mitigation strategies

Additives supplementation

Medium Chain Fatty acids (MCFA) such as:
Lauric (C12:0)
Myristic (C14:0)

MCFA can modify:

Ruminal fermentation (Henderson, 1973)
Mitigate CH_4 (Machmüller, 2006)

by direct inhibition of rumen methanogens, (by changing their metabolic activity and abundance)

C12:0 = 470 g/kg
C14:0 = 180 g/kg

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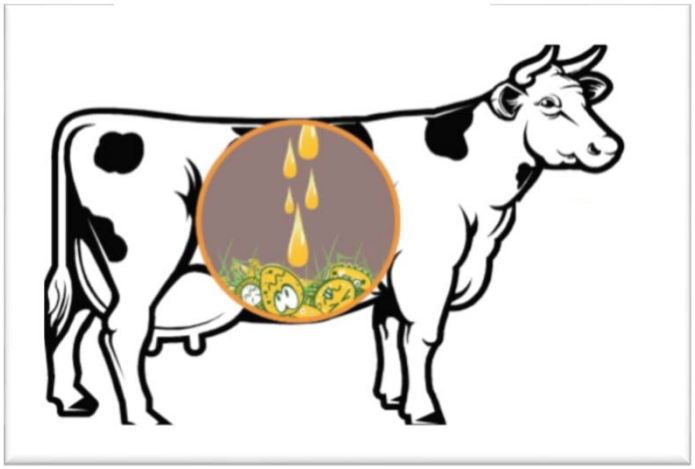
Lipid supplementation

DMI

Detrimental effect
above 6-7 % kg DM

Milk yield



Digestibility

Low
productivity

Daily gain

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Early life supplementation strategy

Early life supplementation modifying rumen microbial community, to program rumen function (methanogenesis)

…with a certain persistency later in life (Abecia *et al*. 2012)

Short term effect

Repeated treatment???

Methanogenesis???

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Objective:

Whether the MCFA supplementation during pregnancy might have an effect on *in vitro* offspring methane production.

Whether the dose response on *in vitro* methane production is influenced by an earlier exposure of the ruminants to the same treatment (early in life).

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Materials and methods

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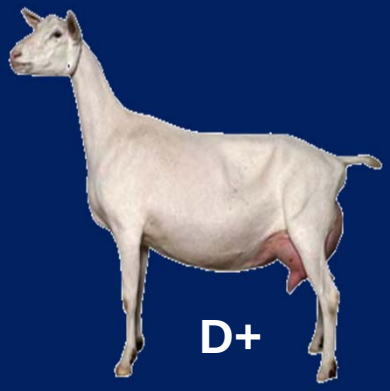
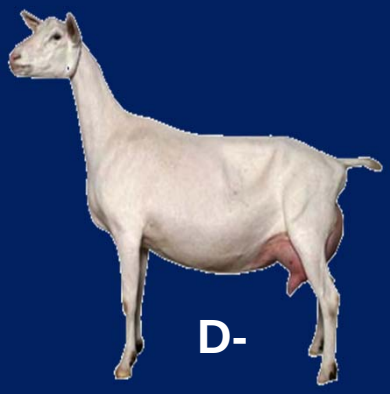
Does treatment





60 Saanen pregnant Does (65±2 kg)

D+ and D- (n = 30)

(D+) treated three weeks before lambing

40 g/d of MCFA

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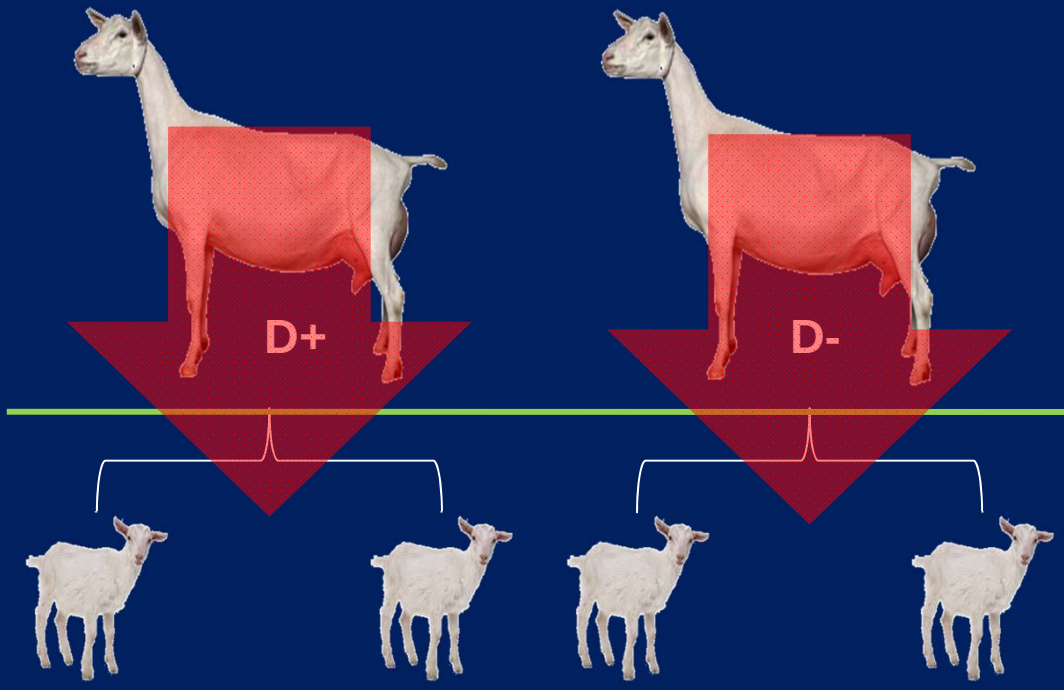
Kids treatment



Kids were allocated 2 by 2

2.5 L/day (milk powder)

500 g/day of goat concentrate

Hay and water *ad libitum*

0.9 ml twice a day before feeding

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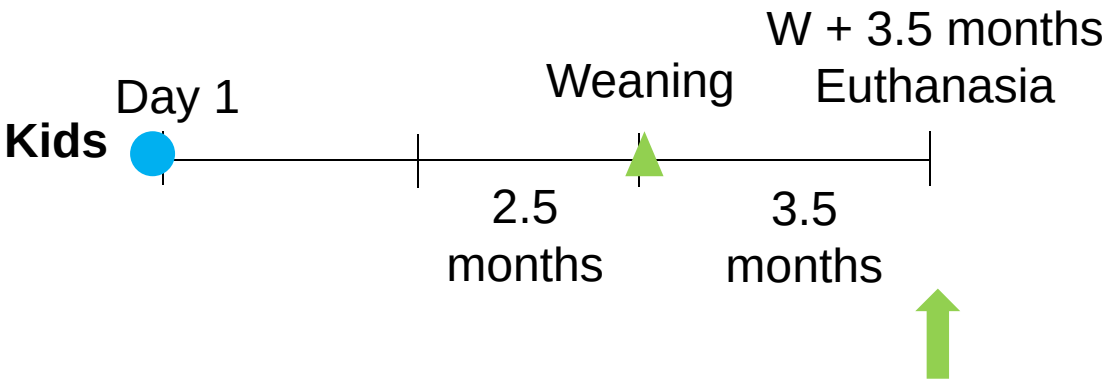
Sampling



- Birth and Kids start treatment
- Ceased MCFA treatment and all the kids grouped together
- Rumen fluid

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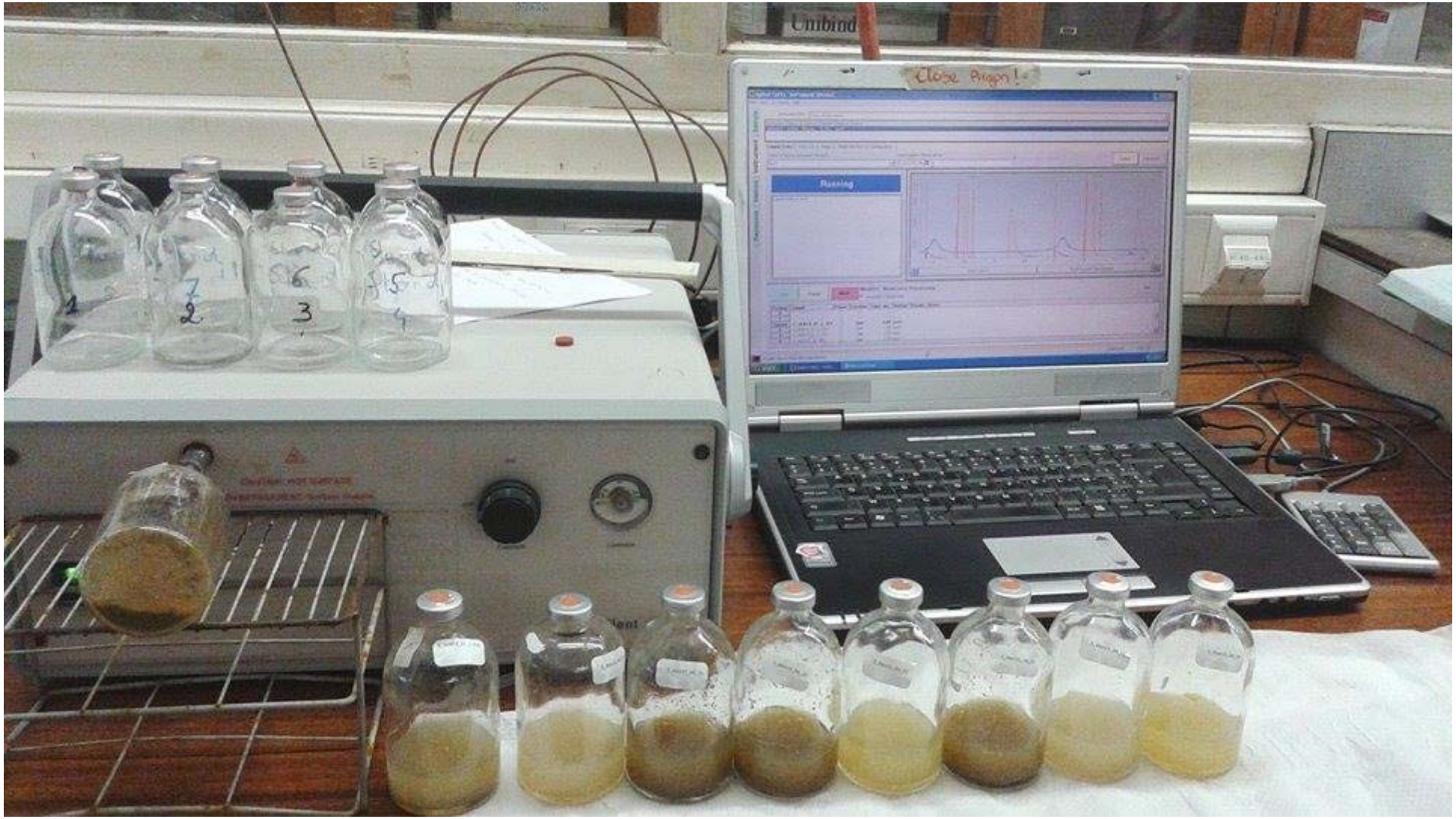
In vitro incubation

Materials and methods (2)

Results



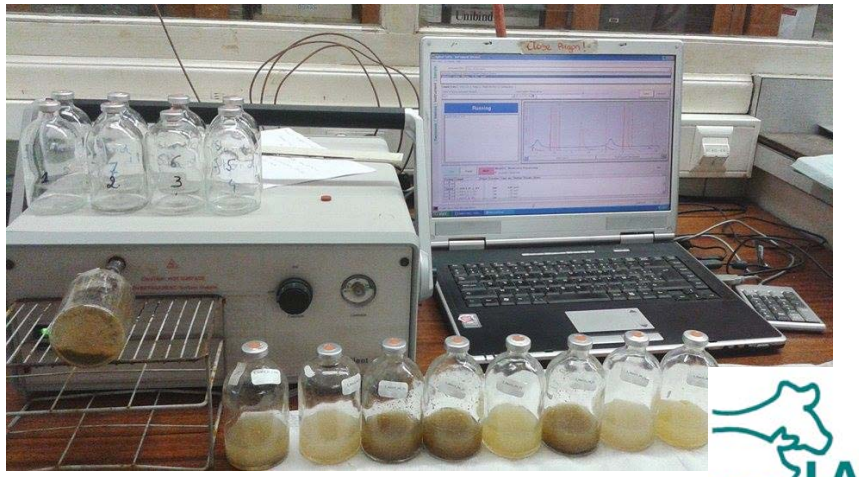
Material and methods

1. Effect on *in vitro* offspring methane production

10 ml/kid

Substrate: dry grass silage (250 mg/flask)

Incubated for 24 h (39 °C)



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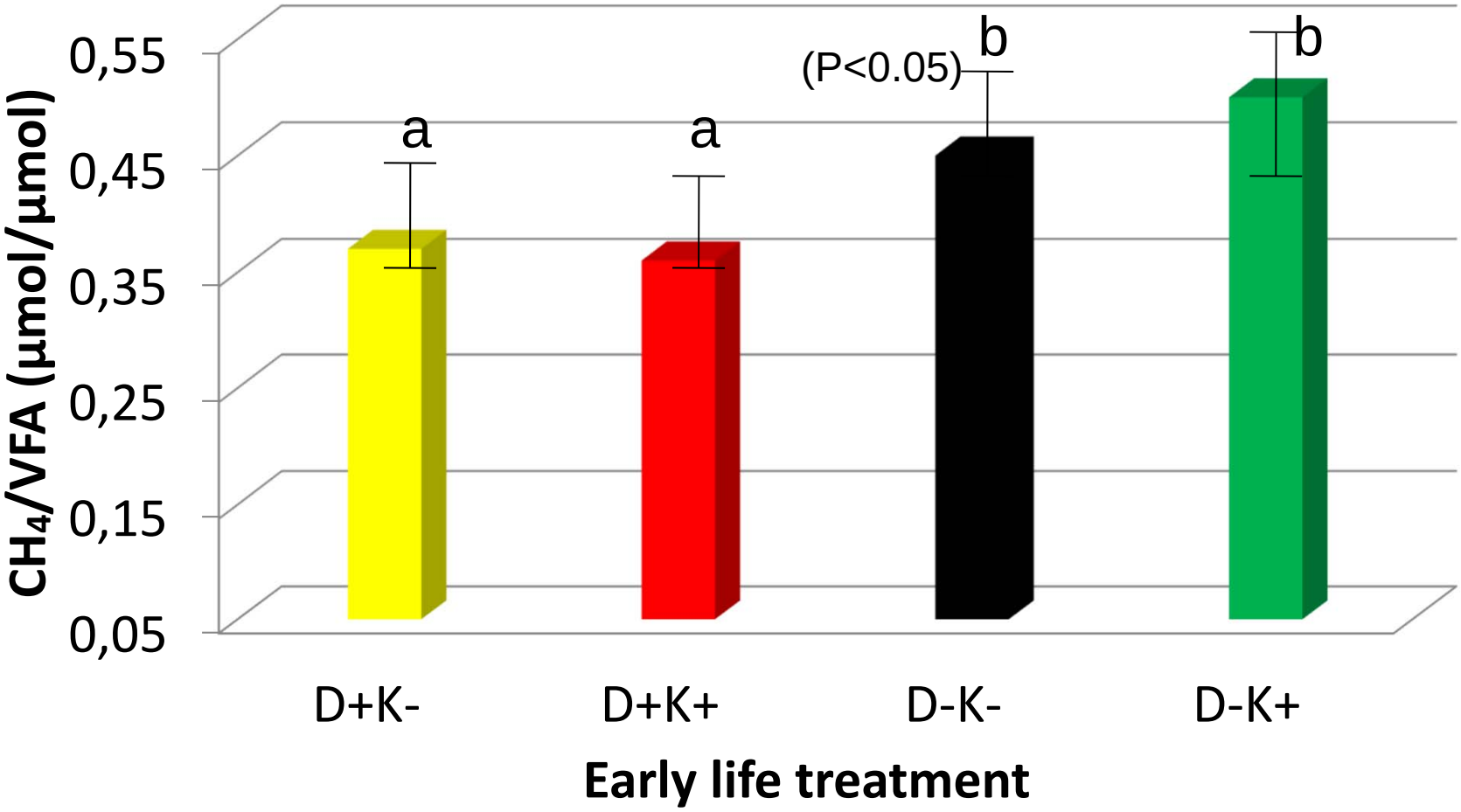
Results

CH_4/VFA ratio after 24 h of *in vitro* incubation



Material and methods

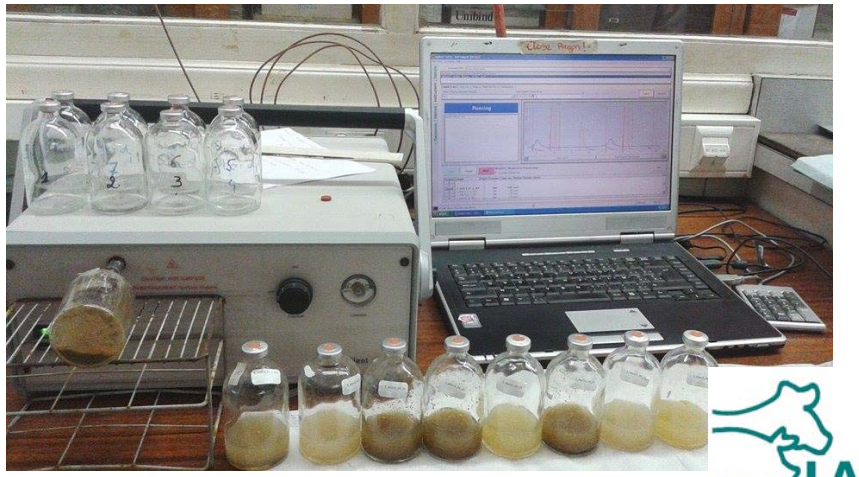
2. Dose response on *in vitro* CH_4 production

40 ml/kid

Five doses of MCFA (0, 15, 30, 60 and 120 mg) – two flasks (5 mL)

Substrate: dry grass silage (250 mg/flask)

Incubated for 24 h (39 °C)



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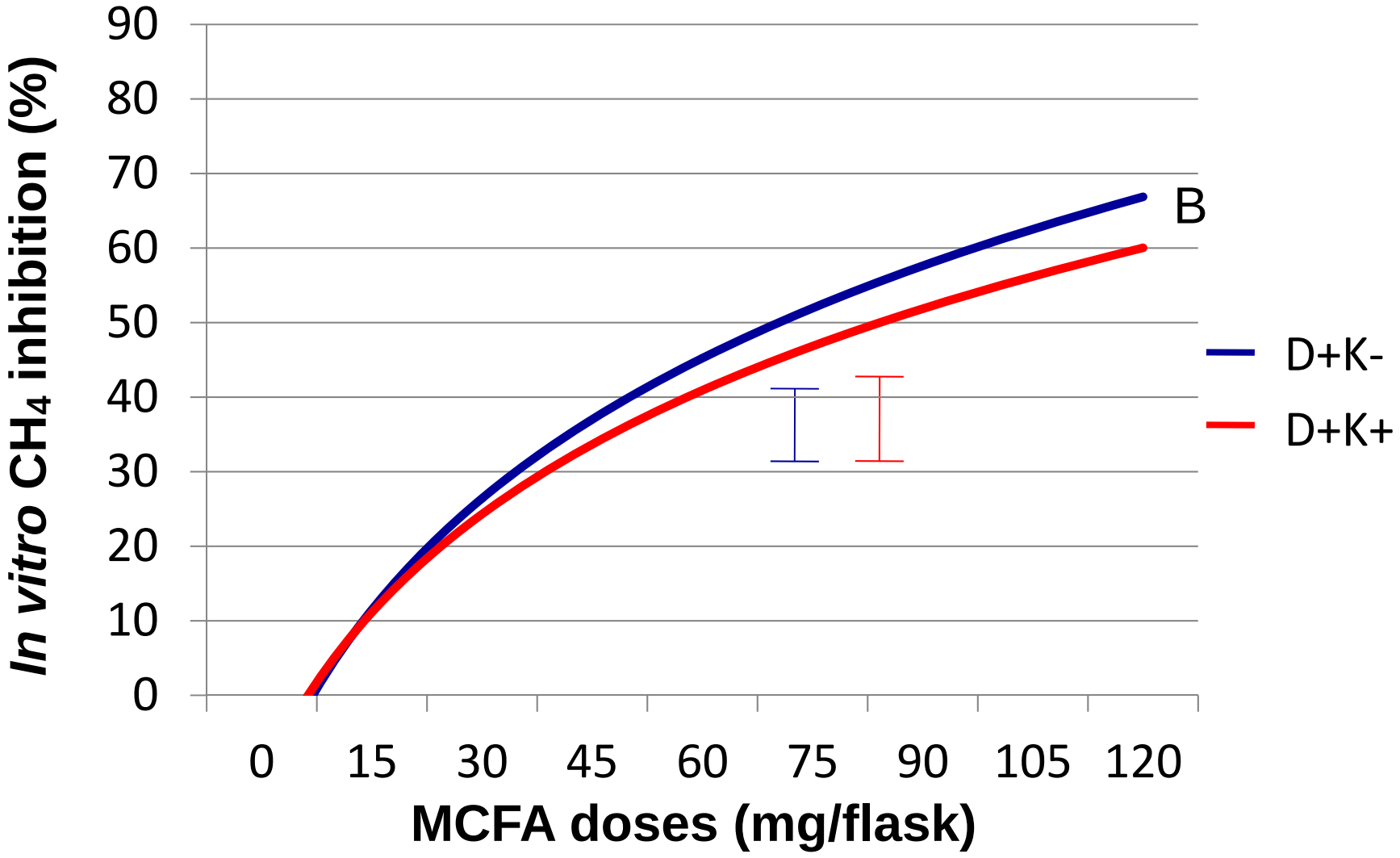
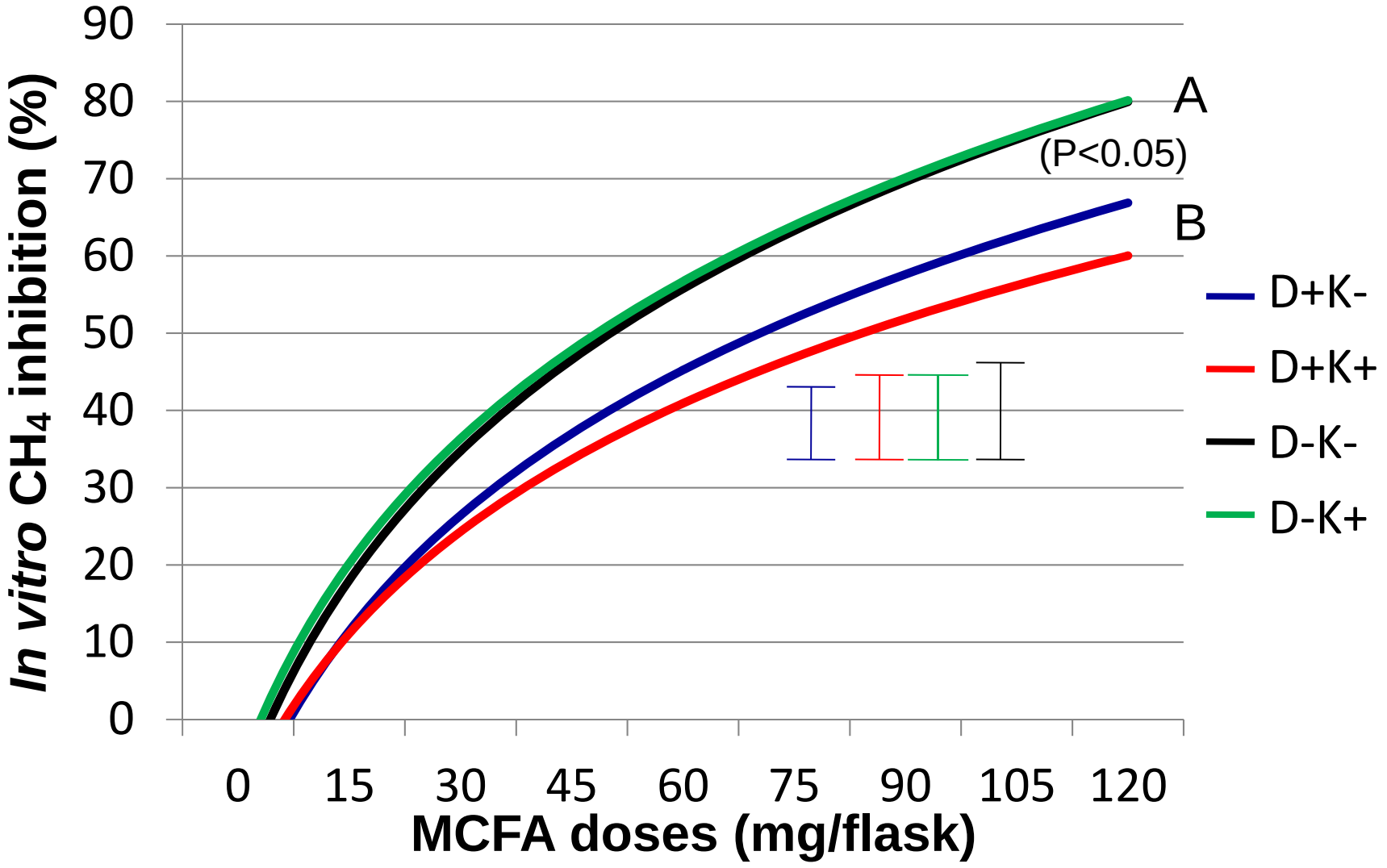
Results

Logarithmic curve fitting of *in vitro* CH_4 inhibition



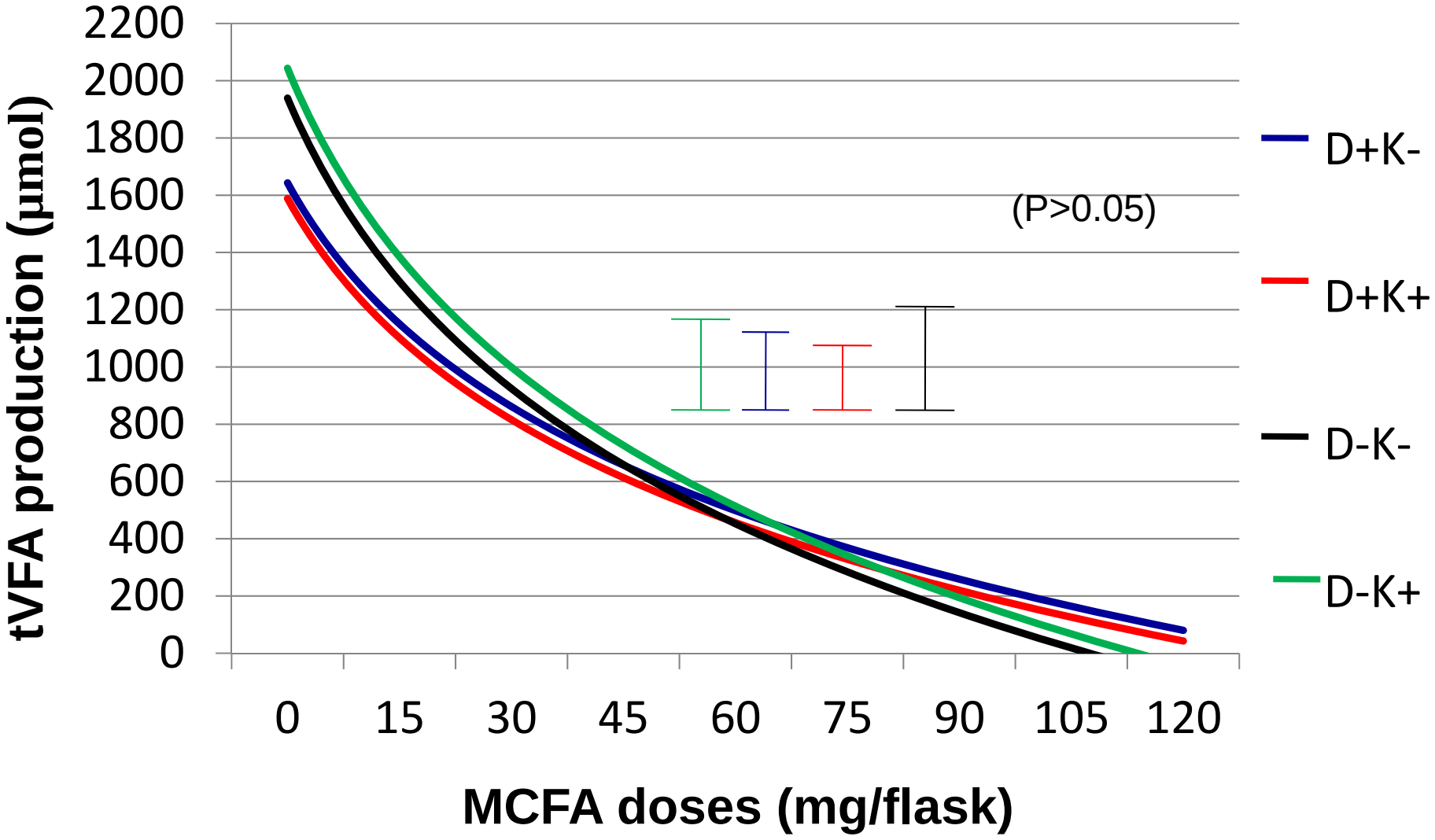
Results

Logarithmic curve fitting of *in vitro* CH_4 inhibition



Results

Logarithmic curve fitting of *in vitro* tVFA production



Conclusion

- Supplementing goats at the end of the pregnancy with MCFA might program the offspring to produce less methane

- MCFA effect was smaller in inoculum from kids of treated does, suggesting that their microbes may have adapted to the MCFA effect



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