# Slurry chemical characteristics and ammonia emissions assessed by different methods

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# Introduction

**Ammonia** (**$NH_3$**) causes negative <u>environmental effects</u> :

eutrophication, soil acidification, fine particulate aerosols and indirect $N_2O$ emissions.

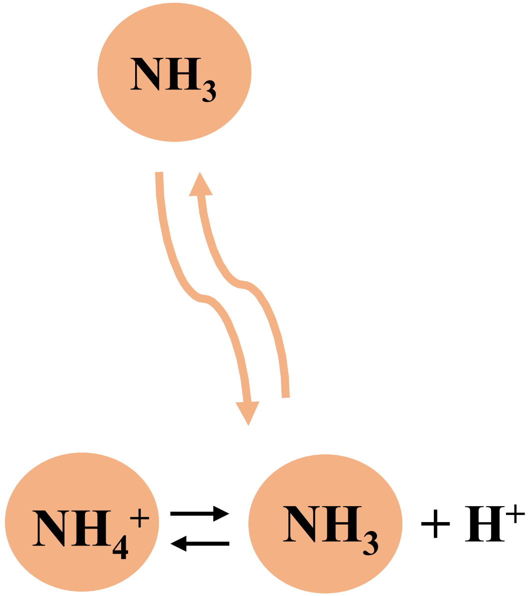
Also, on <u>animal and human health</u>

In Europe, 80% $NH_3$ originates from livestock facilities (Reidy et al., 2009)

A major contribution derivate from slurry management

Source of ammoniacal nitrogen:

- Urea
- Decomposition of protein from organic matter



# Introduction

## Nutritional strategies

- **Reducing Crude Protein content**

↓ Excretion of N

- **Addition of Feed Additives**

Increase feed efficiency

Modulate microbial population

Acidification of excreta

Reduce the emission of toxic gases

(Morazan, 2015; Seradj et al., 2018)

## *in vitro* trials VS *in vivo* trials

- Reduce the use of experimental animals
- Welfare and ethics limitations
- Economic costs and time
- Repeatability
- Possibility of measuring efficiently more gases

# Objectives

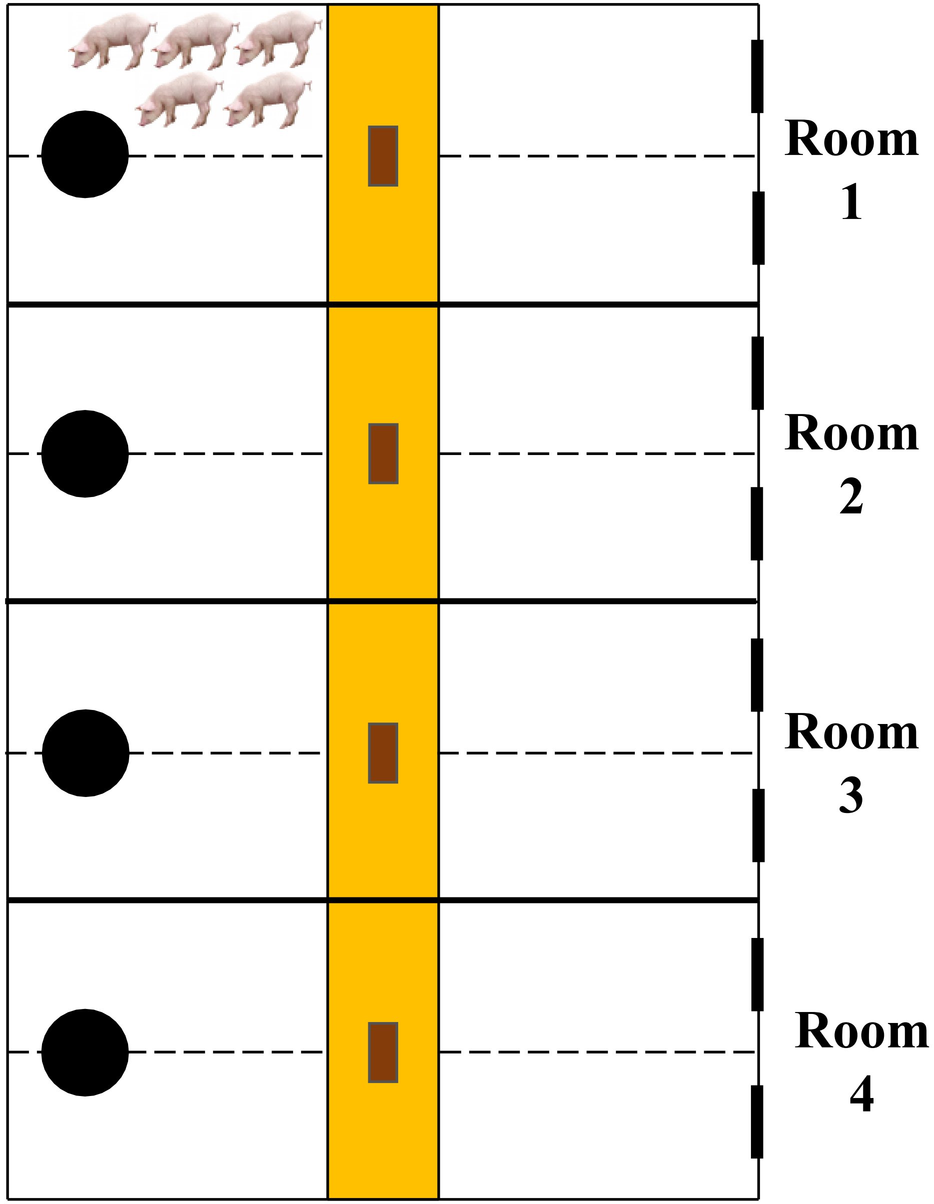
Use of a slurry pit simulator and an *in vivo* trial to evaluate the effect of dietary CP and the presence or absence of feed additives on:

- Chemical characteristics of slurry: % DM, % OM, % N and pH
- Emission of $NH_3$

# Material & Methods

## (*in vivo* trial)

- 80 growing pigs
- (Landrace x Large White) x Pietrain
- 33.48 (± 0.436) kg BW, 3 months of age
- 4 rooms separated by isolation doors



# Material & Methods

## (*in vivo* trial)

- ❑ Carbohydrate enzymes
- ❑ Organic acids
- ❑ Essential oils and plant extracts

**2 x 2 factorial design** | **Crude Protein level** | **Feed Additives**

During 6 weeks

*Ad libitum*

- **Standard** Crude protein (**16.14 %** CP)
  - **Absence** → **Standard Control** → Room 1
  - **Presence** → **Standard Additive** → Room 2
- **Low** Crude protein (**14.50 %** CP)
  - **Absence** → **Low Control** → Room 3
  - **Presence** → **Low Additive** → Room 4

# Material & Methods

**Every three weeks…**

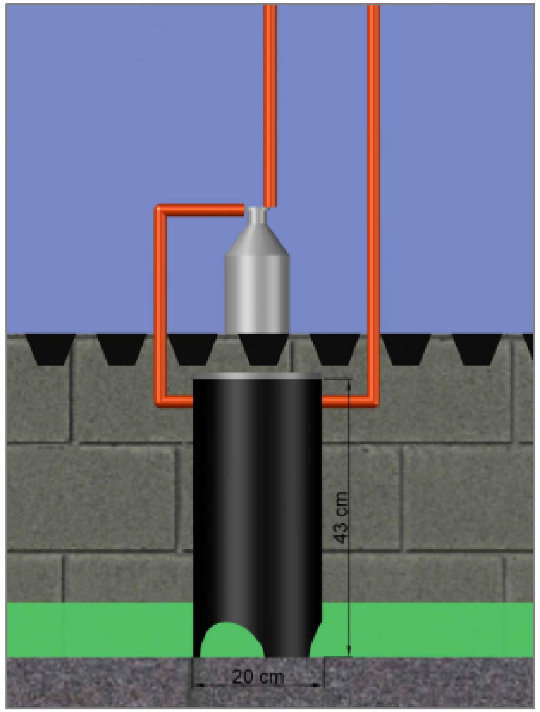
## (*in vivo* trial)


- Slurry was obtained from the slurry pit

- **$NH_3$** emissions were collected during 48 h from: **slurry pit**

**Dynamic flow chambers:**

- 283.5 $cm^2$
- Single clean air inlet
- Single air outlet




**Vacuum air pump:**

- Air flux 3 L/min

**Acid solution:**

- 100 mL of $H_2SO_4$ (0.5 M)

$$H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$$

# Material & Methods

## (*in vitro* trial)

**Metabolic cages** during 5 days:

- 4 pigs/each dietary treatment
- Individual samples of feces and urine
- Measurement of individual excretion

Individual **pit simulator container:**

- Mixed feces and urine (0.5 kg) in proportion to excretion
- 4 weeks at 20ºC
- Daily addition of 15 mL of the same mixture
- Slurry sampling every week (50 mL)

# Material & Methods

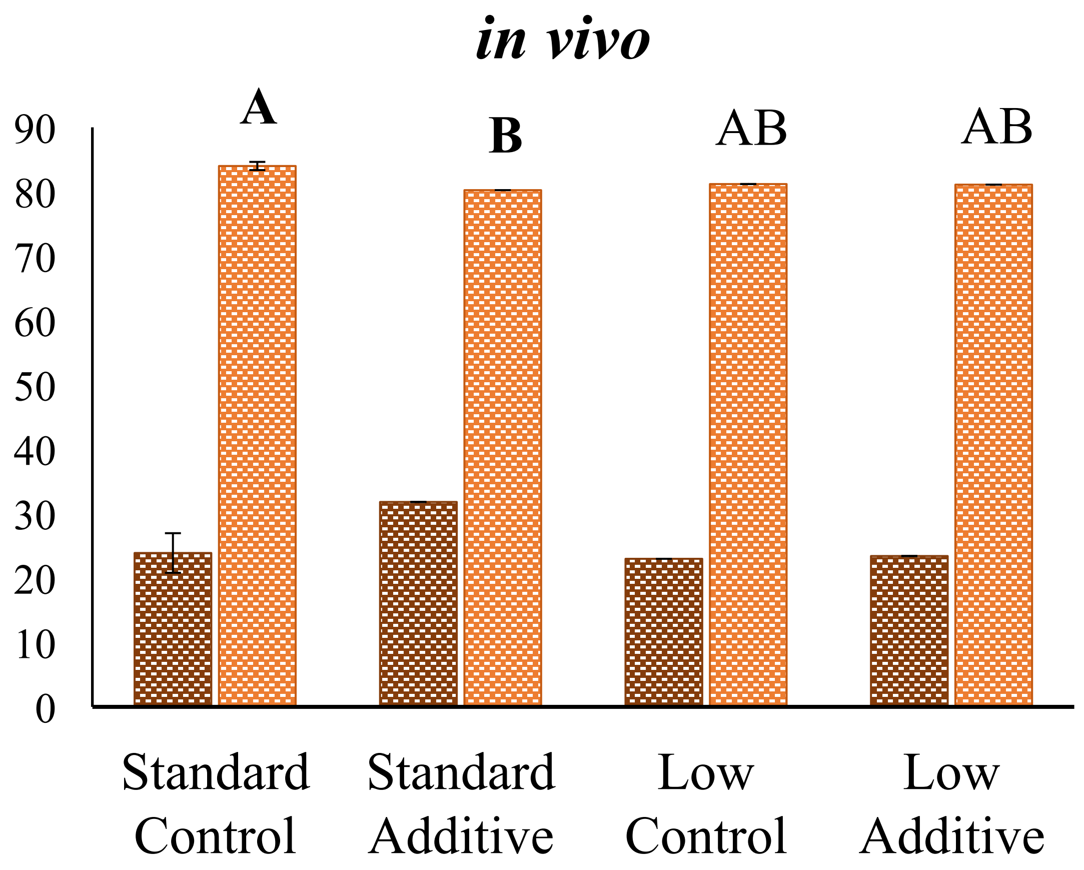
## (*in vitro* trial)

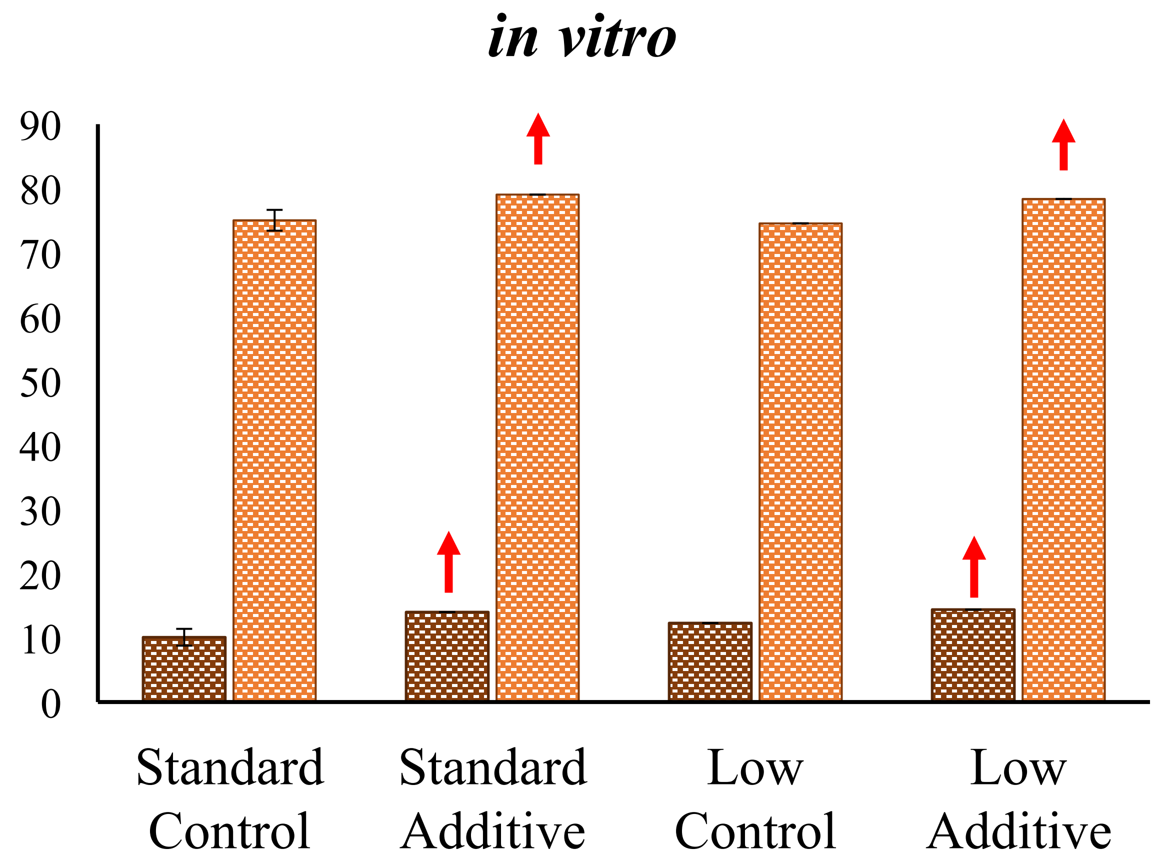

**$NH_3$ sampling**

- During 48 h
- Air inlet and outlet
- Vacuum air flow (1.2 L/min)
- Acid solution, 100 mL of $H_2SO_4$ (0.5 M)
- Measure N-$NH_3$ in form of $(NH_4)_2SO_4$ through Kjeldhal method (AOAC, 2010)

# Results

**% DM and OM**




Interaction between CP and Additive

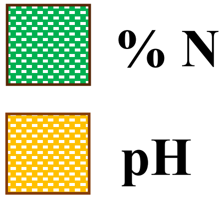
(*P* = 0.045)

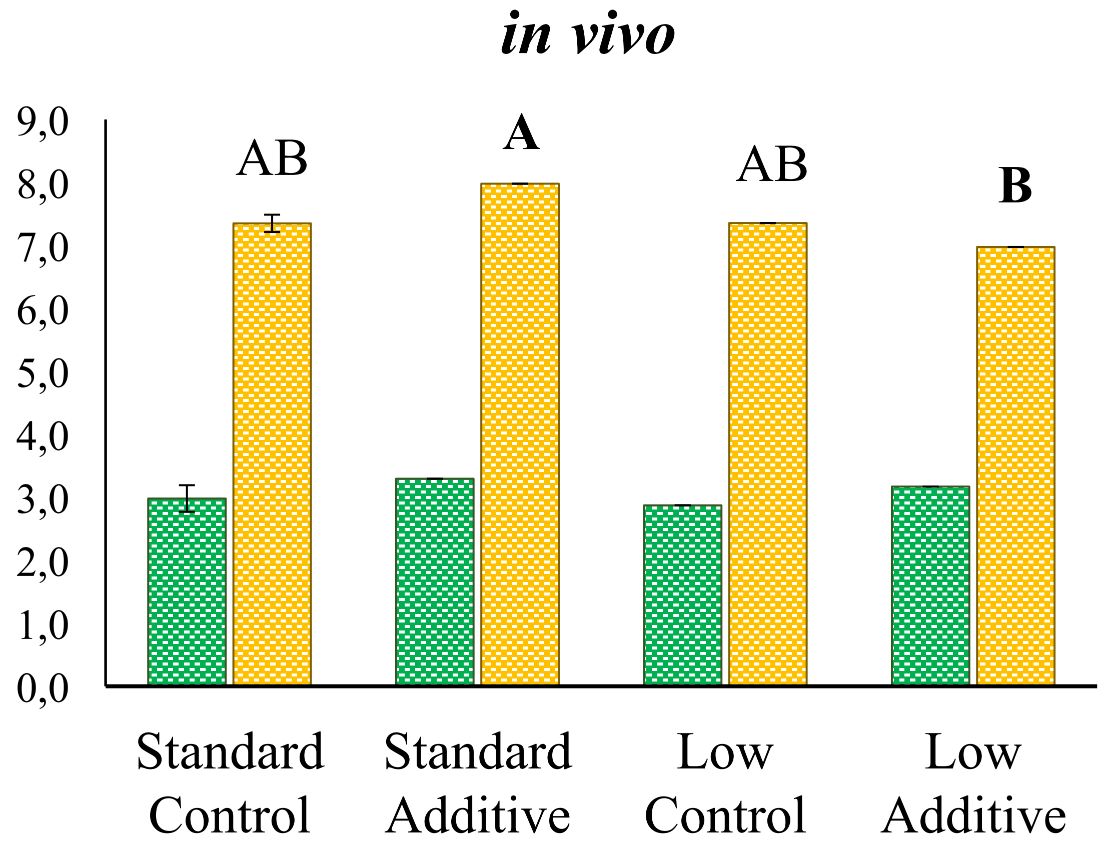
The Additives increased the % DM and % OM

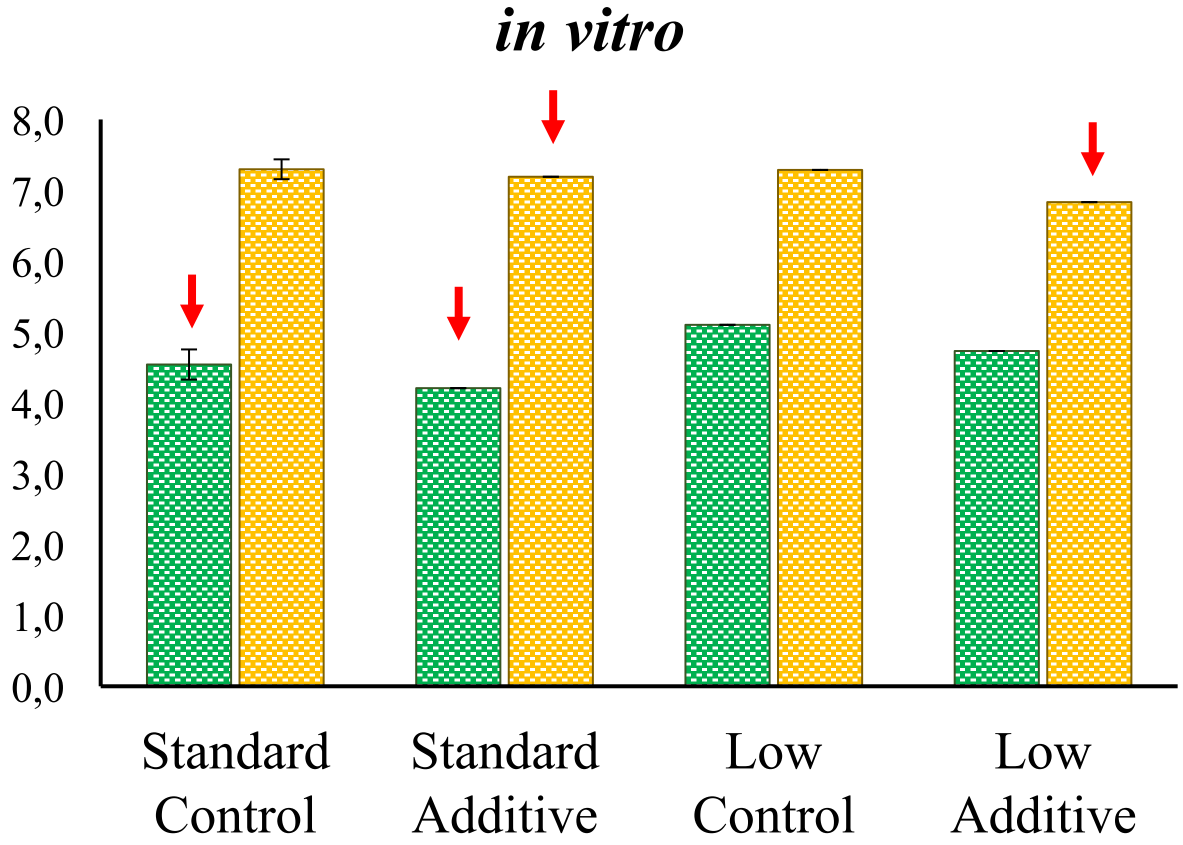
(*P* = 0.025) *and* (*P* = 0.019), respectively

# Results

**% N and pH**




Interaction between CP and Additive ($P$ = 0.021)

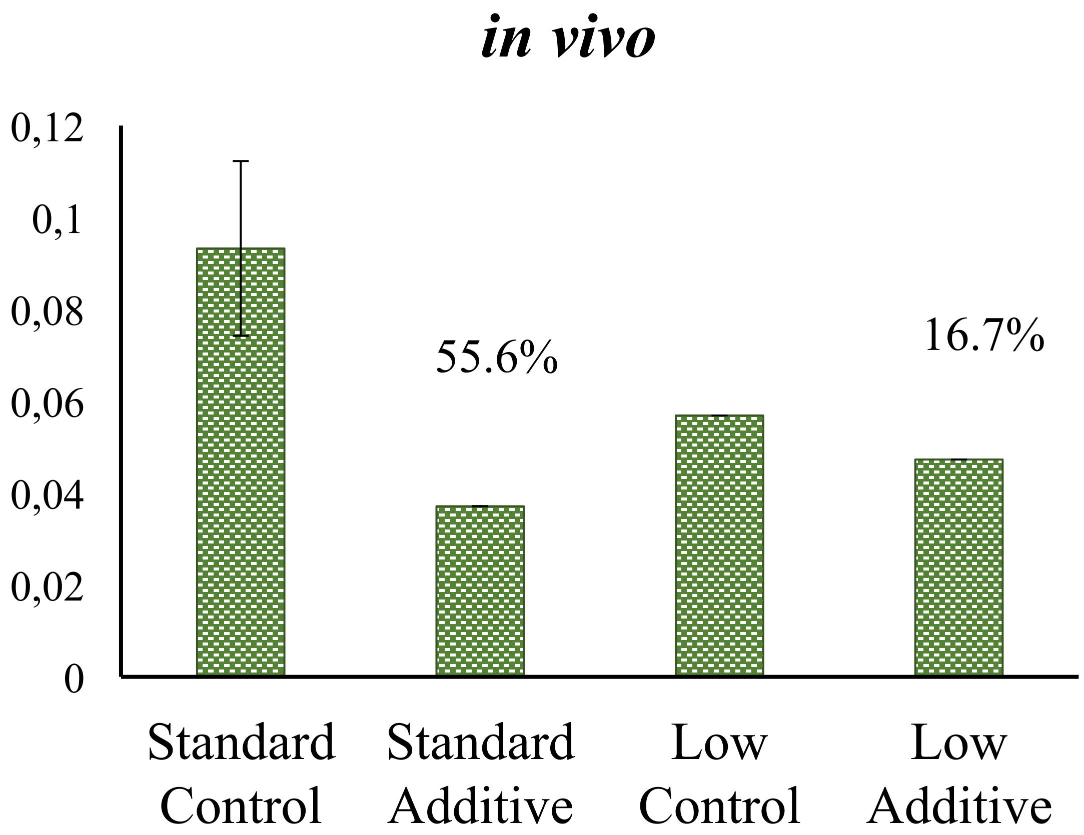
Standard CP-pigs presented lower % N ($P$ = 0.013)

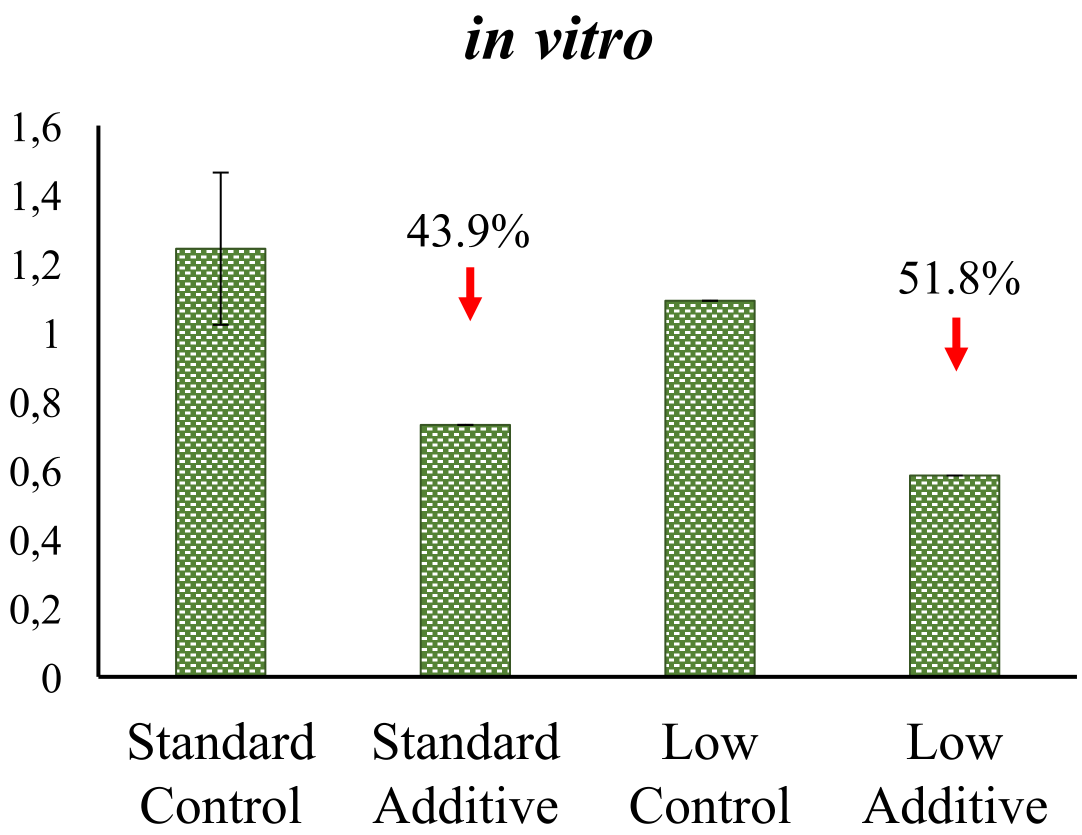
The additive acidified the slurry ($P$ = 0.05)

# Results

## $NH_3$ Emissions (g/day)

($P$ = 0.013)




* The additives decreased the emission of $NH_3$

# Conclusions

Both *in vivo* and *in vitro* methods presented differences in the chemical composition, probably due to other factors (animal behavior, temperature fluctuations, feed drops into slurry, etc.), especially in the *in vivo* system.

The *in vitro* method was sensible enough to detect differences in $NH_3$ emissions when feed additives were included, probably associated with the changes in pH values.

# Thank you for your attention!

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