



# Lactic acid bacteria & yeast-based postbiotic boosts the immune system in dairy heifer calves

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**SOUTH DAKOTA STATE UNIVERSITY**

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# Biotics and their potential effects

**Anti-biotic:** Type of antimicrobial drug used in the treatment and prevention of bacterial infections

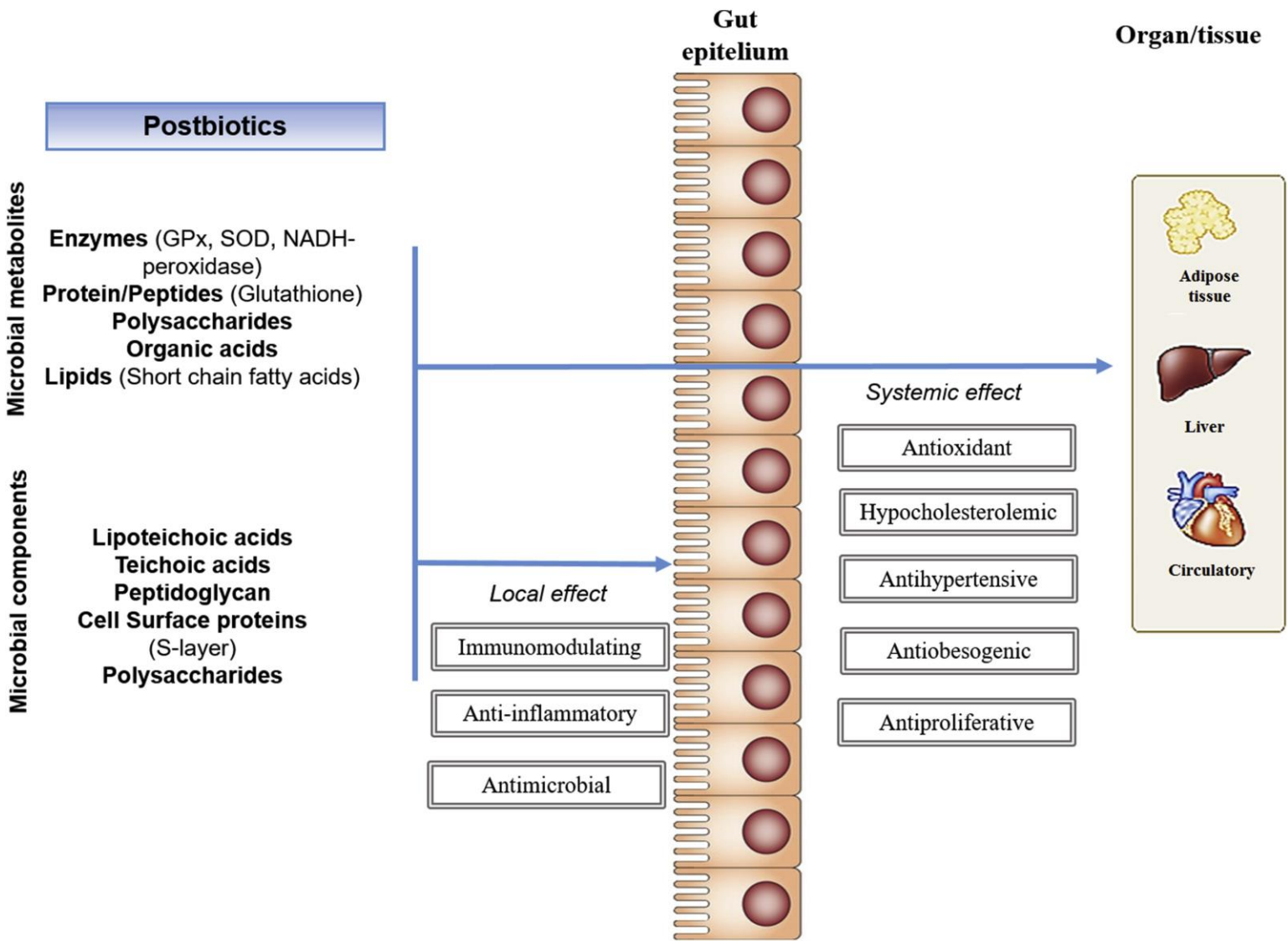
**Pro-biotic:** Microorganism/s that are claimed to provide health benefits when consumed

**Pre-biotic:** Food ingredients that induce the growth or activity of beneficial microorganisms

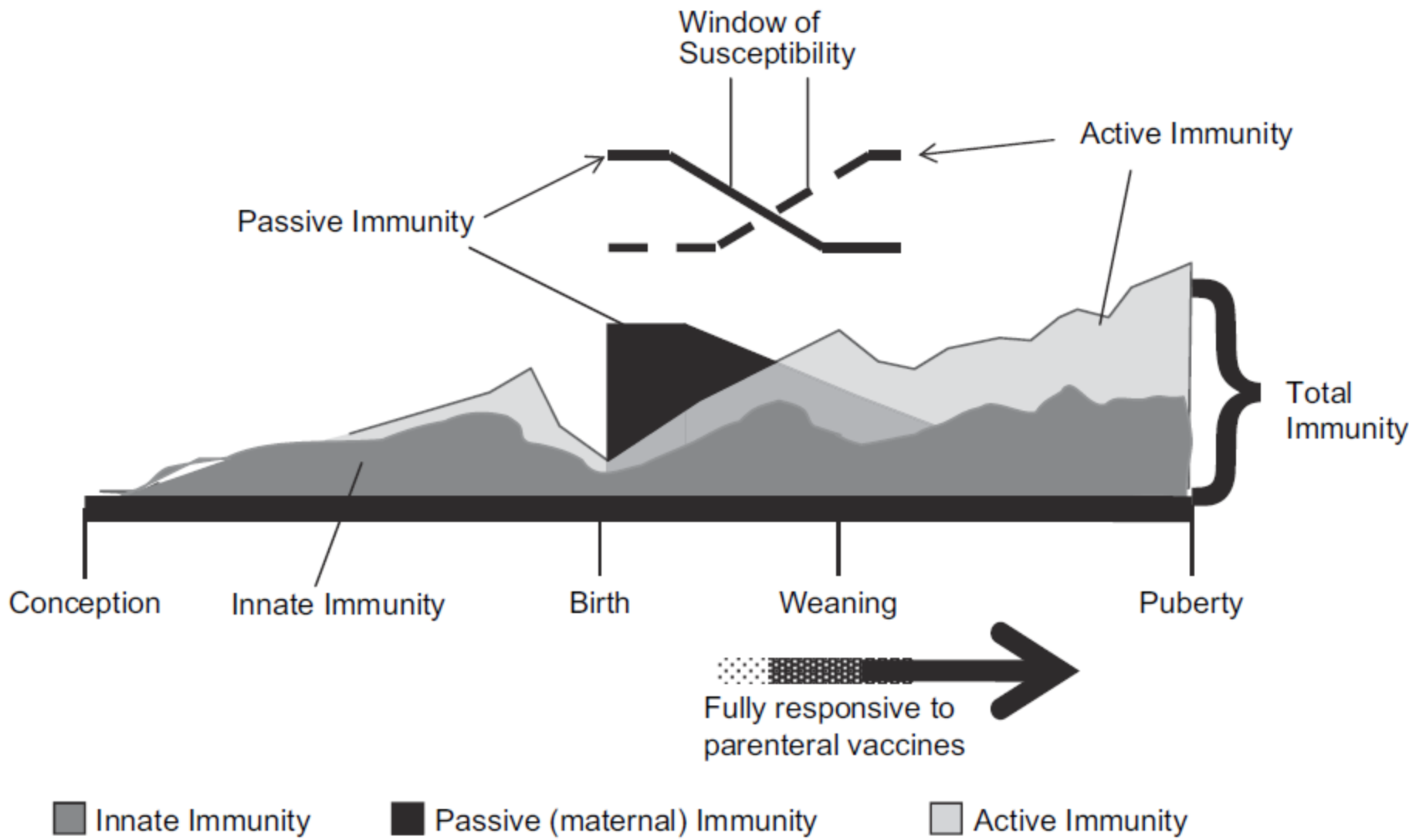
**Post-biotic:** Inactivated microorganism + products or metabolic byproducts from probiotic microorganisms



# Postbiotics and their potential effects

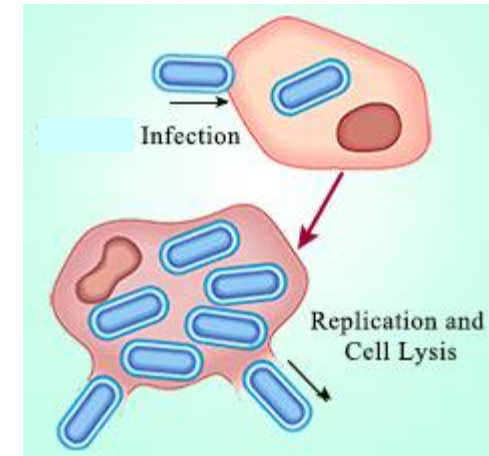


# Development of the immune response in calves



# *E. Coli* & *Salmonella*

- Both *E. coli* and *Salmonella* are **major pathogens** in calves.
- *E. coli* (intracellular or extracellular) may:
  - Cross the intestinal wall and enter the bloodstream (*septicemia*). **Closure of the intestinal barrier!**
  - Produce toxins that cause localized intestinal inflammation (*enterotoxemia*).
- *Salmonella* (facultative intracellular) does not injure the intestine as much as *E. coli* infections, but does cause profuse diarrhea.



Biologywise.com



# Hypothesis & Objectives

Feed supplementation with a postbiotic (Probisan<sup>®</sup>) has immunomodulation effect and will improve the immune system of calves

- Evaluate the effect of supplementation with a **lactic acid bacteria & yeast-based postbiotic** (Probisan<sup>®</sup>) from **birth to week 18** of age on:
  - Growth
  - Blood Immunoglobulins (IgG)
  - Concentration of **IgA** in **nasal secretions**
  - Response of blood cells to lipopolysaccharide challenge





# Materials & Methods

- Hammink commercial **large dairy** with 4000 cows in SD
- Winter (T = -35 to 4°C)
- Animals & Management:
  - **70** crossbred Jersey-Holstein dairy heifer calves
  - Individual hutches from birth to weaning at wk 8
  - Feeding 2.6 L pasteurized waste milk 3 X/d
  - Starter from day 14
  - After weaning, group of 5/hutch
  - Concentrate and alfalfa hay ad libitum



# Materials & Methods

## ■ Treatments:

- Control without supplement (n = 35)
- Supplemented with postbiotic (Probisan<sup>®</sup>, Pentabiol S.L., Navarra, Spain; n = 35):
  - **3 g/d** in milk from d 3 to weaning at wk 8
  - **1.5 g/kg** added to the concentrate mixture



Horizon 2020 EU fund 2 M €

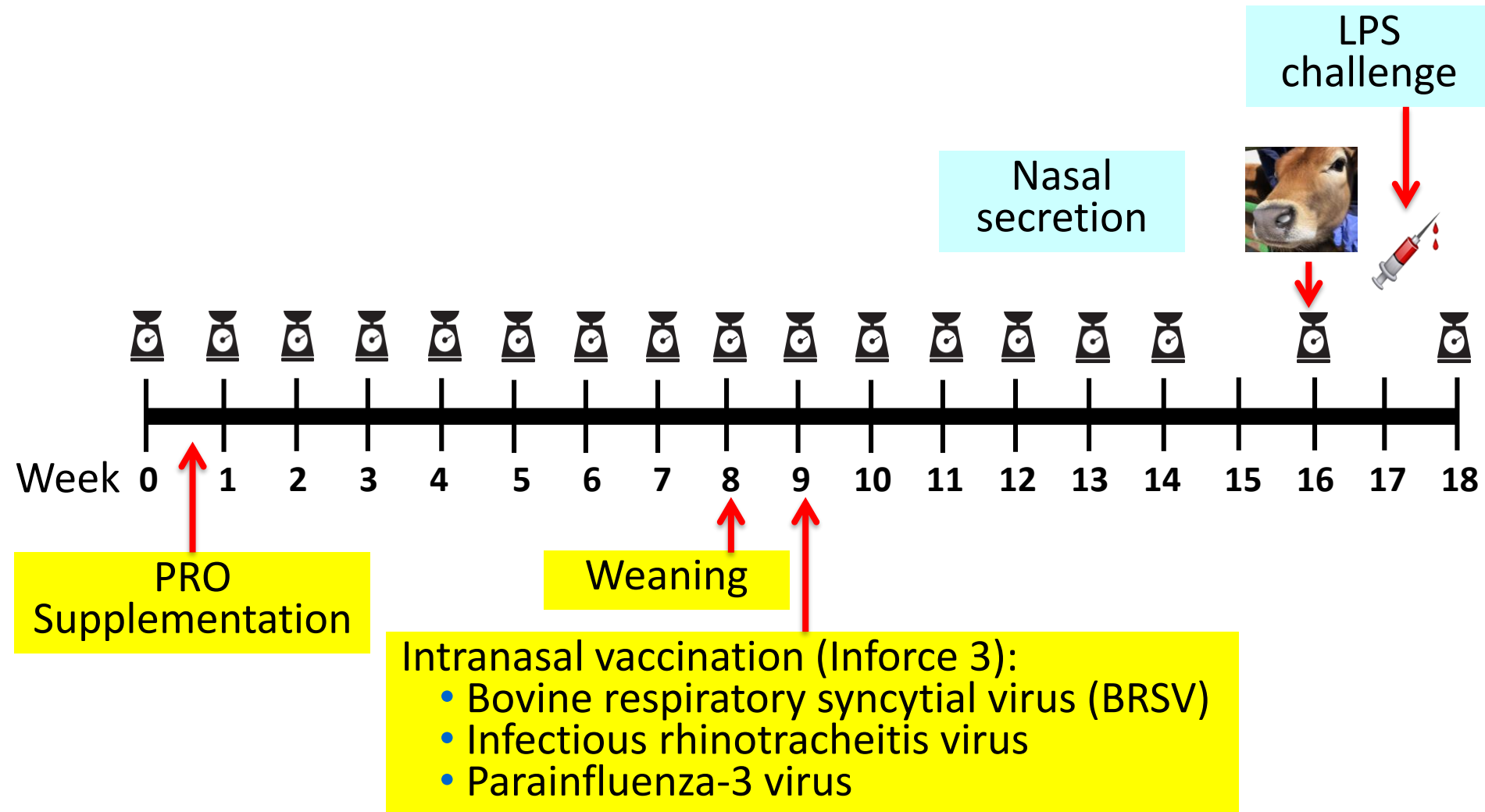


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# Materials & Methods



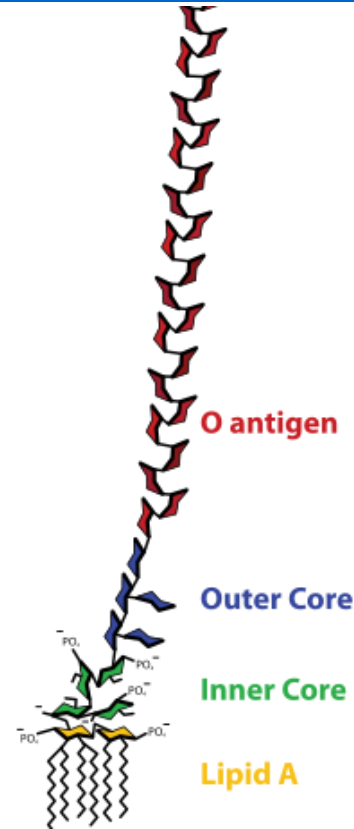
# Materials & Methods

- Collection of nasal secretions (wk 16):
  - 46 calves (n = 23 per treatment)
  - Sponges inserted for 5 min
  - Secretion obtained by syringe
  - Secretions Frozen at  $-80^{\circ}\text{C}$
  - Analysis of:
    - Total IgA
    - Specific BRSV-IgA
  - Analysis by ELISA



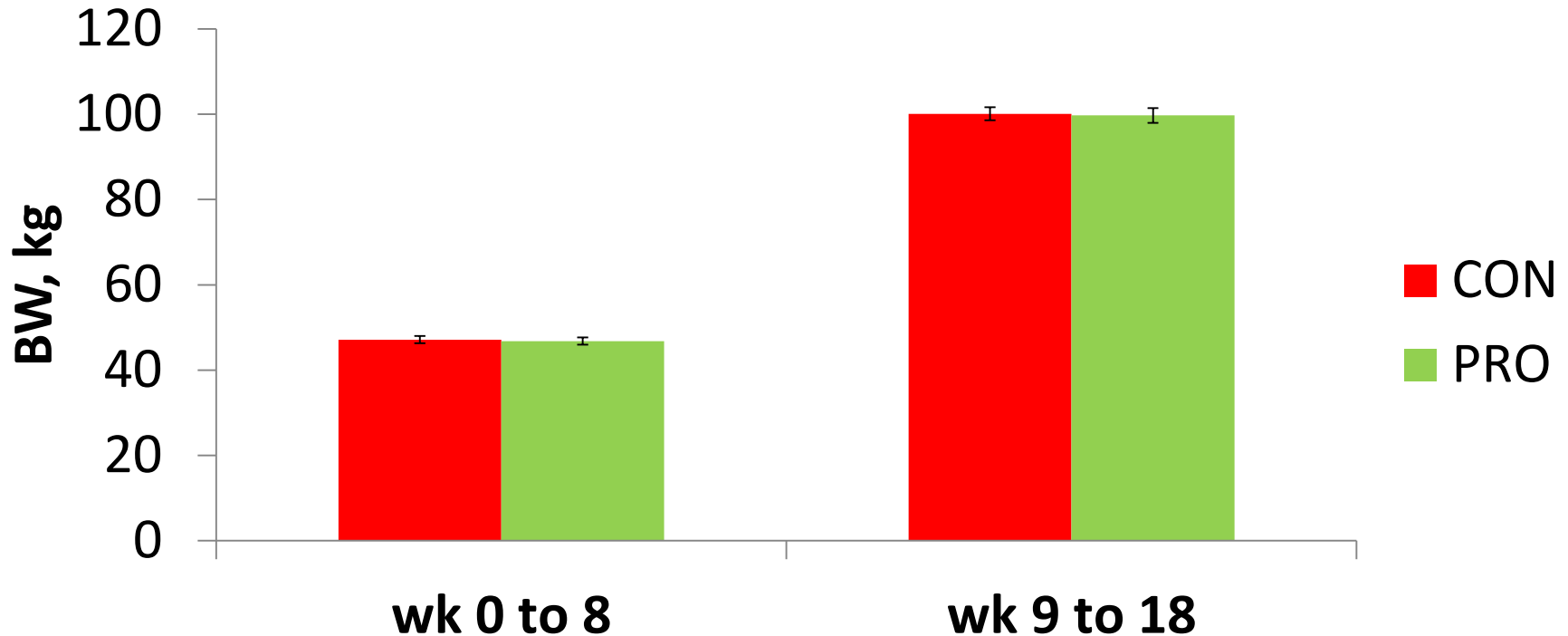
# Materials & Methods

- Blood cell challenge with LPS (wk 17):
  - Blood collection (n = 10/treatment)
  - Incubation at 38°C for 3.5 h with:
    - *E. coli* LPS (O111:B4; Sigma-Aldrich)
    - *Salmonella* LPS (*Salmonella typhimurium* SL1181; Sigma-Aldrich)
  - For each LPS, 2 doses:
    - 0.01 µg/mL (physiologic)
    - 5 µg/mL (maximal immune response)
  - Centrifugation and analysis of IL-1β in plasma
- Statistical analyses:
  - BW by mixed model (treatment, week, interaction)
  - Immune response by GLM (treatment)



# Results

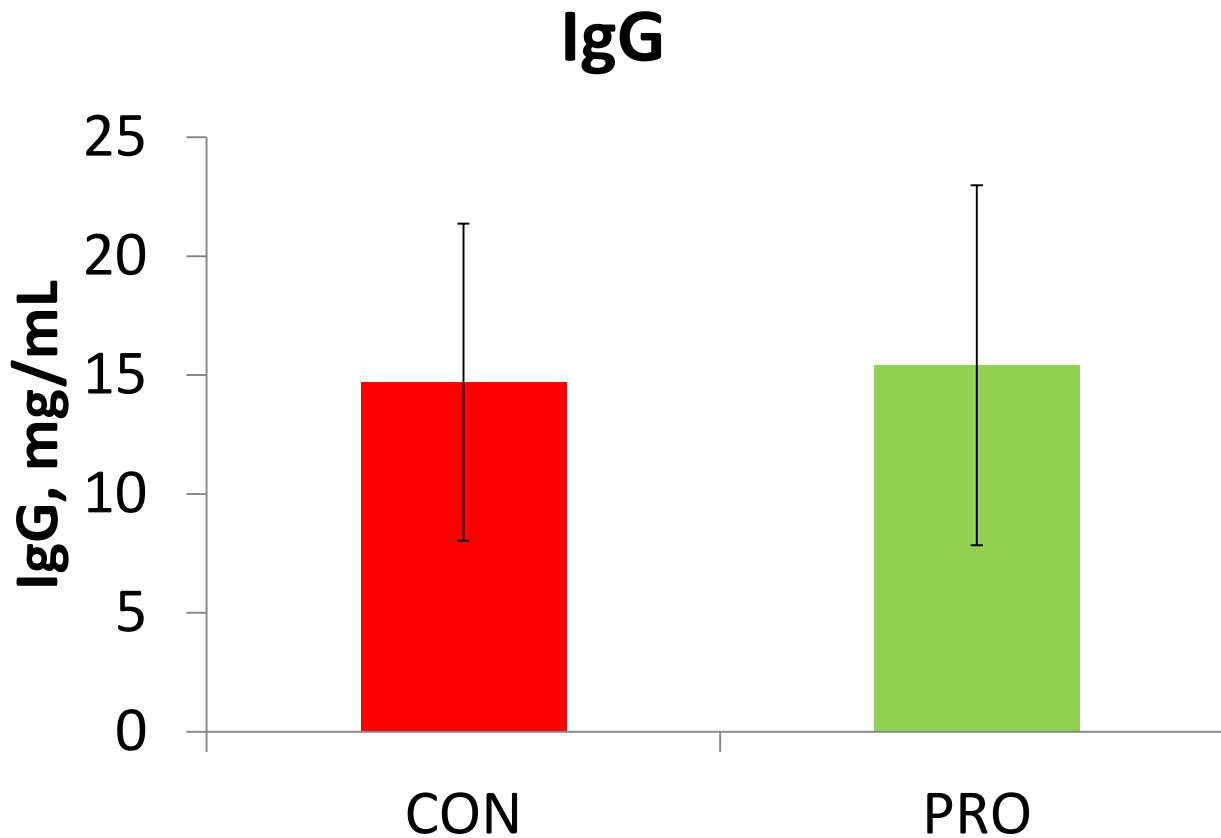
## Body weight



More results on performance will be orally presented:  
Abstr. # **202**, Monday at 4:15 pm in Ballroom C



# Results: blood IgG



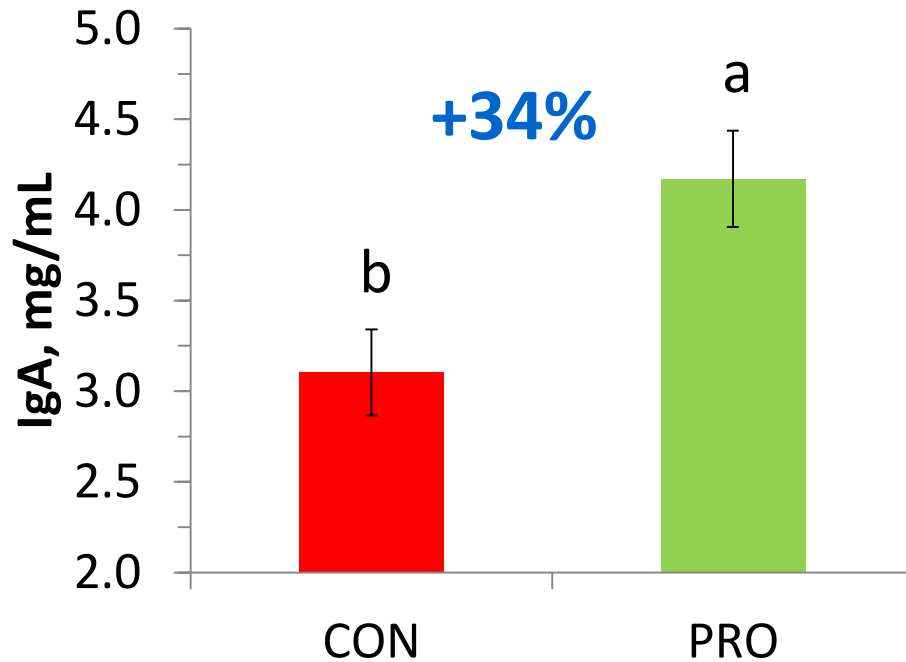
No effect on IgG concentration ( $15.1 \pm 6.6$  mg/mL)

a, b indicate difference at  $P < 0.05$

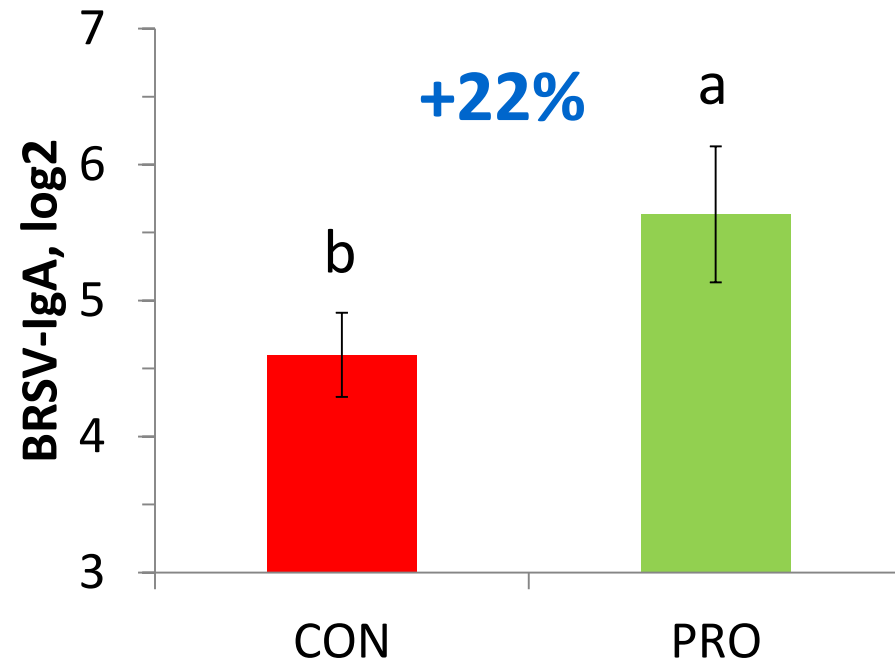


# Results: IgA in nasal secretions

## Total IgA



## BRSV-IgA



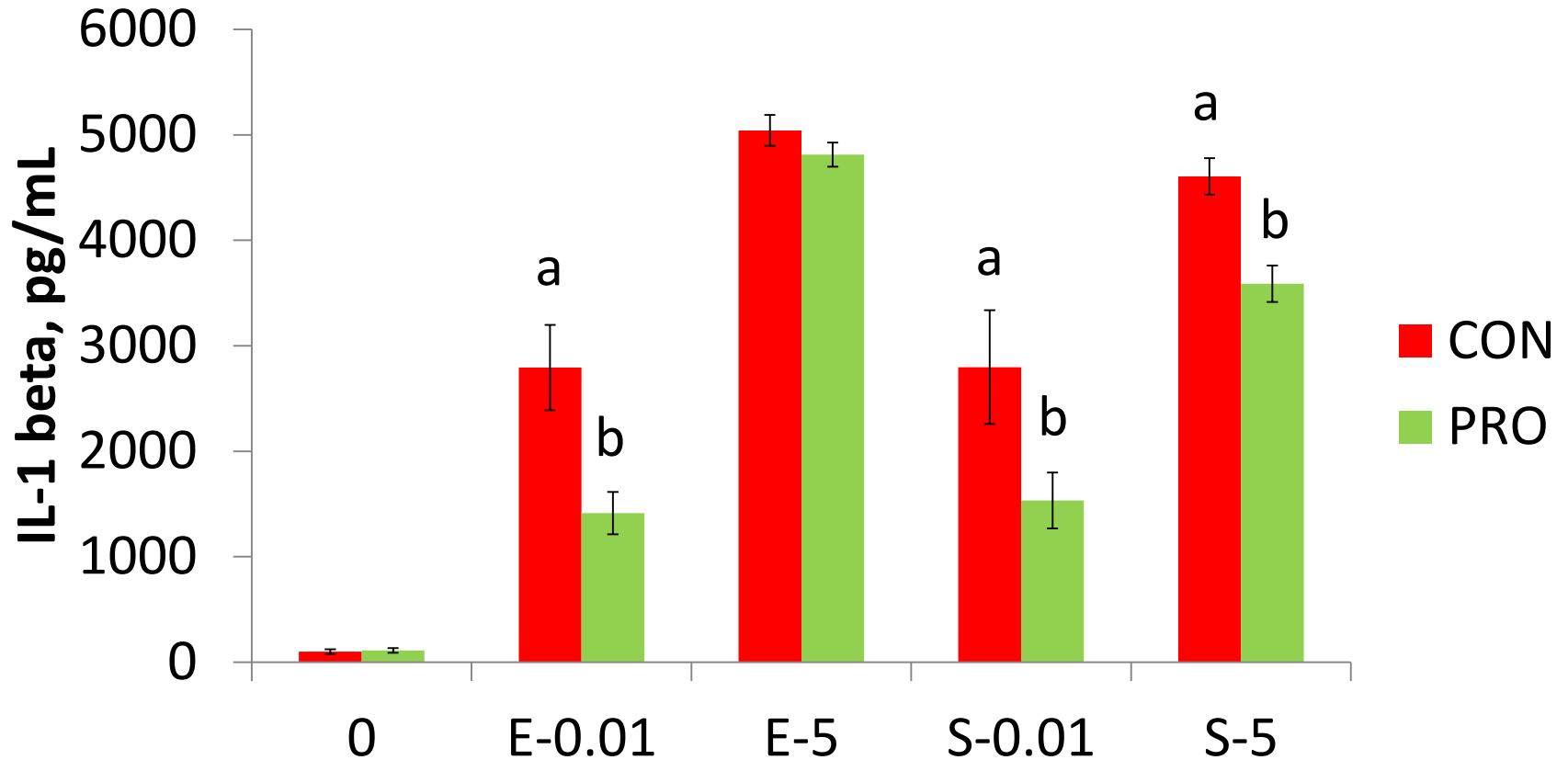
a, b indicate difference at  $P < 0.05$





# Results

## Interleukin-1 $\beta$



a, b indicate difference at  $P < 0.05$

# Conclusions

- Supplementation with a postbiotic (Probisian<sup>®</sup>):
  - Had no effect on blood IgG
  - Increased total IgA & specific BRSV-IgA
  - Less inflammatory response to the lipopolysaccharide
  - Supplemented animals are more prepared to face immune challenges
  - An alternative to antibiotic treatment in dairy calves
- **Future research:**
  - Metabolomics
  - Microbiome
  - Effects during the transition period in dairy cows



# Aknowldgements

- Research funded by PENTABIOL, S. L. Navarra, Spain
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Thank you!



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