

# Effects of olive oil bioactive extracts on immune response in lipopolysaccharide-challenged weaned heifers

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# Olive oil bioactive extracts

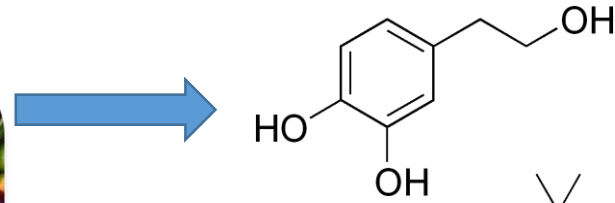
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- **Olive oil has bioactive properties (anti-inflammatory, and anti-oxidant), Sofi et al., 2010**
- **Effects attributed to bioactive molecules, mainly triterpenes and polyphenols**
  - **Found in leaves, and fruit**
  - **Can be extracted from pomace oil**

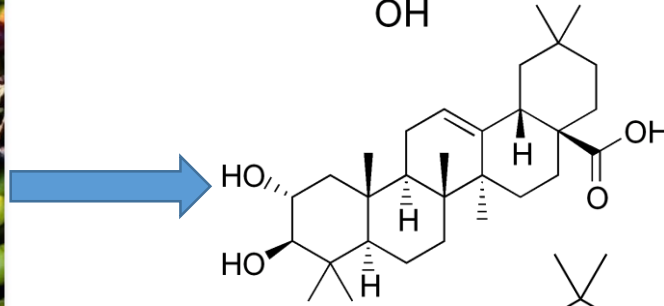


# Olive oil bioactive extracts (OBE)

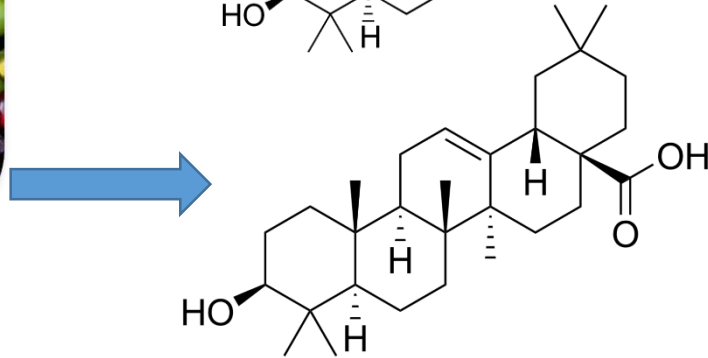
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Hydroxytyrosol (HT)



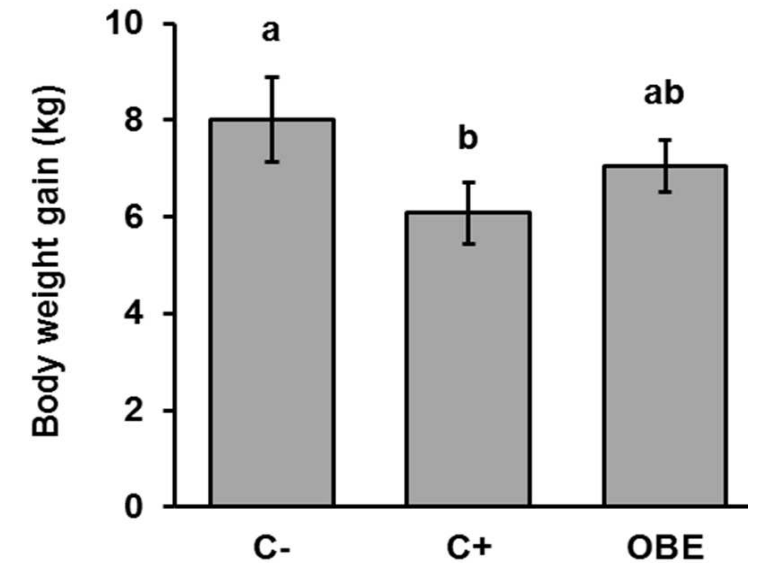
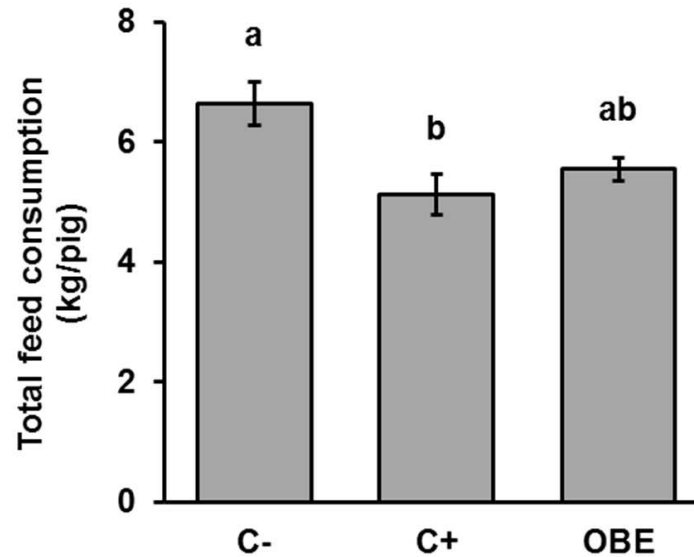
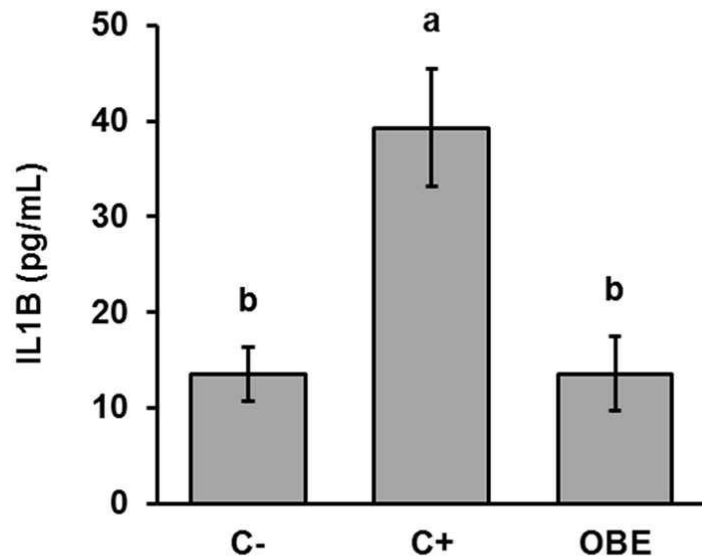
Oleanolic Acid (OA)



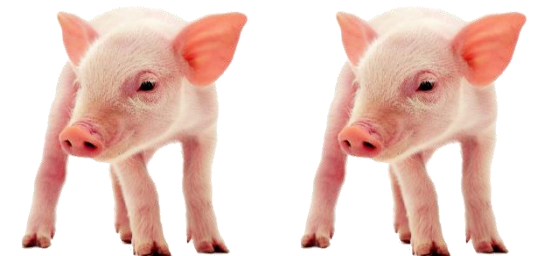
Malsinic Acid (MA)

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- Promising potential to be used as nutraceuticals
  - Dietary supplementation could contribute to reducing the negative effects of subclinical chronic inflammation on animal growth and overall performance

# OBE ameliorated the negative effects of LPS on DMI, and decreased inflammatory markers on weaned piglets



- C- = saline
- C+ = Increasing doses of LPS (60, 66, 72, 78  $\mu\text{g}/\text{kg}$  of BW)
- OBE = LPS + supplementation with OBE at 0.05% of diet



Extracted from Liehr et al., 2017

# *Hypothesis*

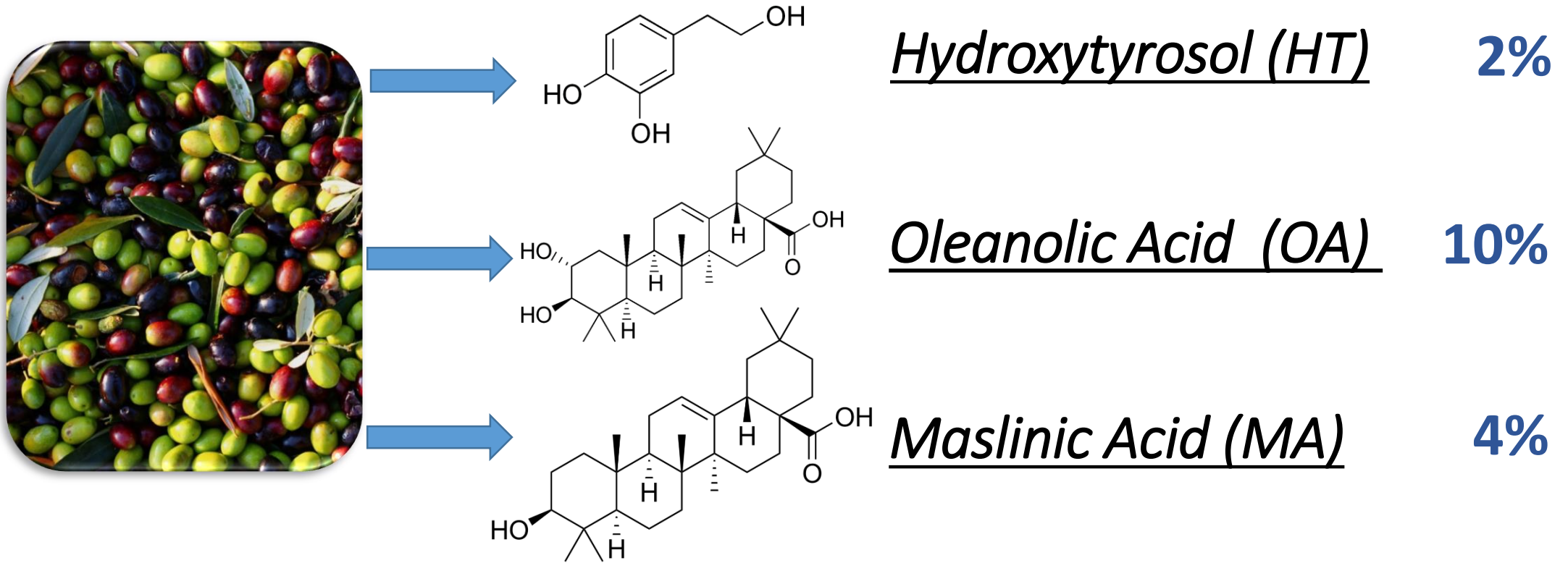
**Feeding olive oil bioactive extracts (OBE) could ameliorate the detrimental effects of LPS challenge through modulation of the immune response and reduction of systemic inflammation**

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# *Objective*

**To evaluate the impact of feeding OBE to newly weaned Angus crossbred heifers injected intravenously with increasing doses of lipopolysaccharide every other day over a 10 d period**

# Olive oil bioactive extracts (OBE)



- Pomace oil was filtrated, bioactive compounds extracted with purified ethanol, dissolved in methanol and quantified by HPLC.
- OBE was standardized to 10% OA, 4% MA, and 2% HT

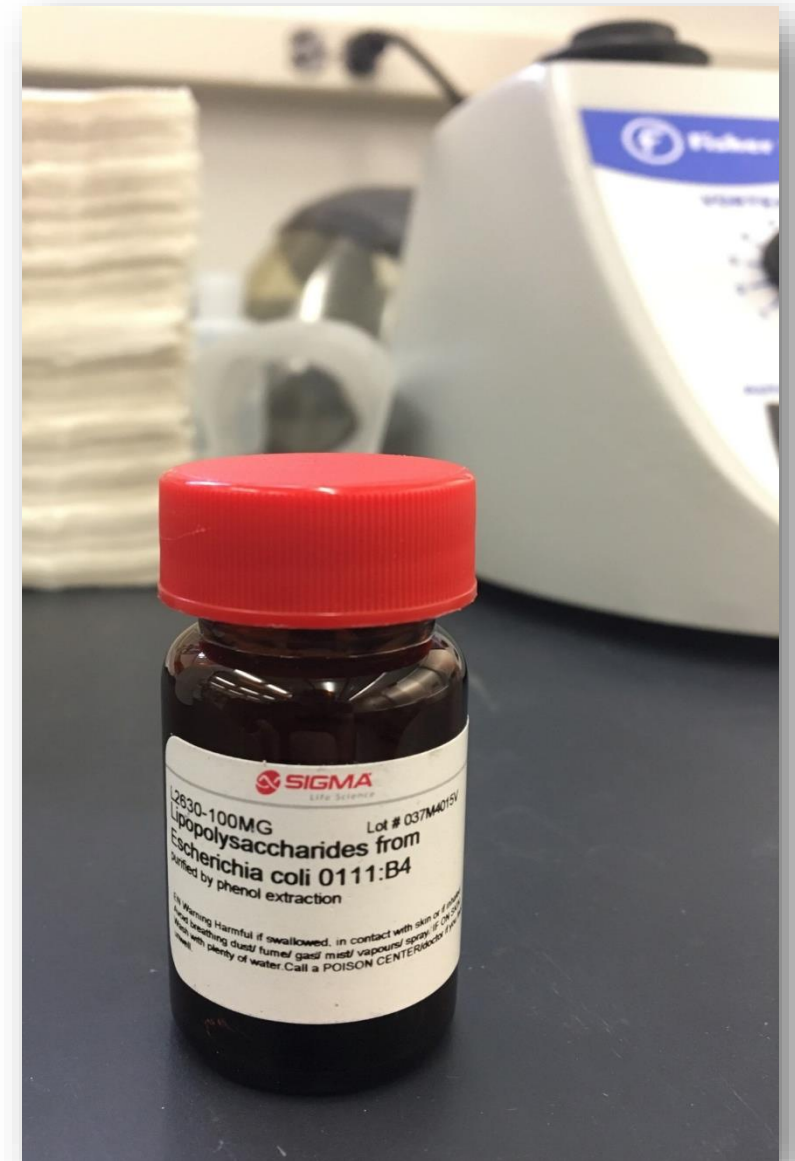
# Materials and Methods

- 36 newly weaned heifers (210 ± 19 kg of BW; 6 mo)  
4 treatments (Trt)
  1. CTL - = Negative control, only saline (n=9)
  2. CTL + = Positive control, LPS (n=9)
  3. OBE-L = OBE 0.04% of diet , LPS (n=9)
  4. OBE-H = OBE 0.16% of diet, LPS ( n=9)
- 21 d adaptation prior to LPS challenge



# Materials and Methods

- LPS, 0111:B4, Sigma # L2630
- Beginning on d 0, LPS was injected intravenously every other day for 10 d (Fernandes et al., 2017)
- Increasing doses of LPS: 0.10, 0.25, 0.50, 0.75, 1.00, 1.25  $\mu\text{g}/\text{kg}$  of BW
- LPS was infused with a winged butterfly needle



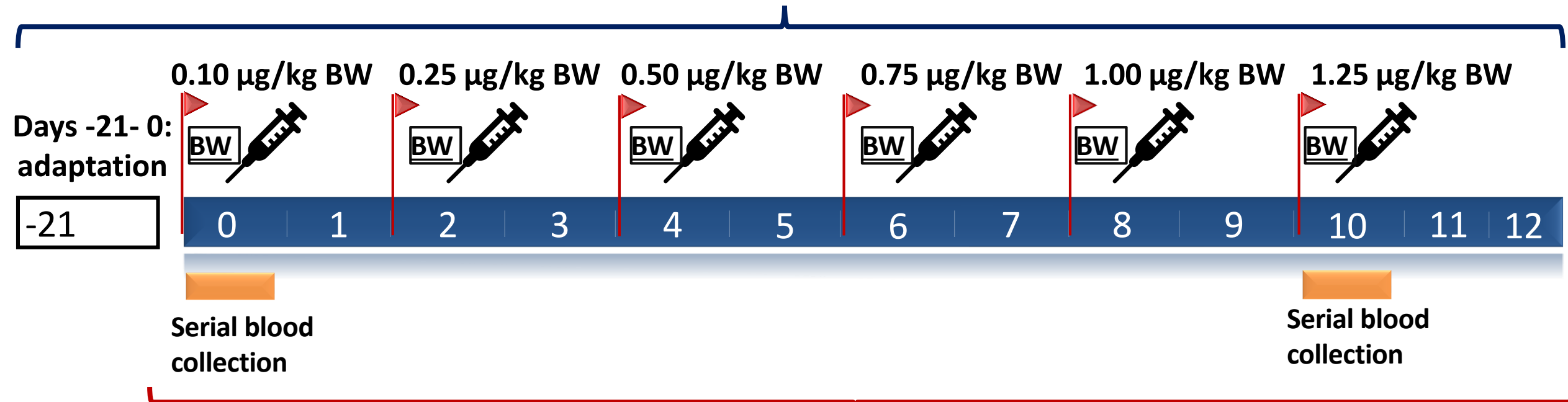


# Materials and Methods

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- Randomized block (period) design with repeated measures
- Mixed Procedure of SAS
- Model included fixed effect Trt, and random effect of period and ID(Trt)
- In addition, for repeated measures: fixed effect of time and Trt × time
- Orthogonal contrasts were performed:
  - CTLPve vs. OBE
  - OBE1 vs. OBE4
  - CTLNve vs. CTLPve
- Significance declared at  $P < 0.05$ , and tendency at  $P < 0.10$

## OBE supplementation



## Daily blood sampling

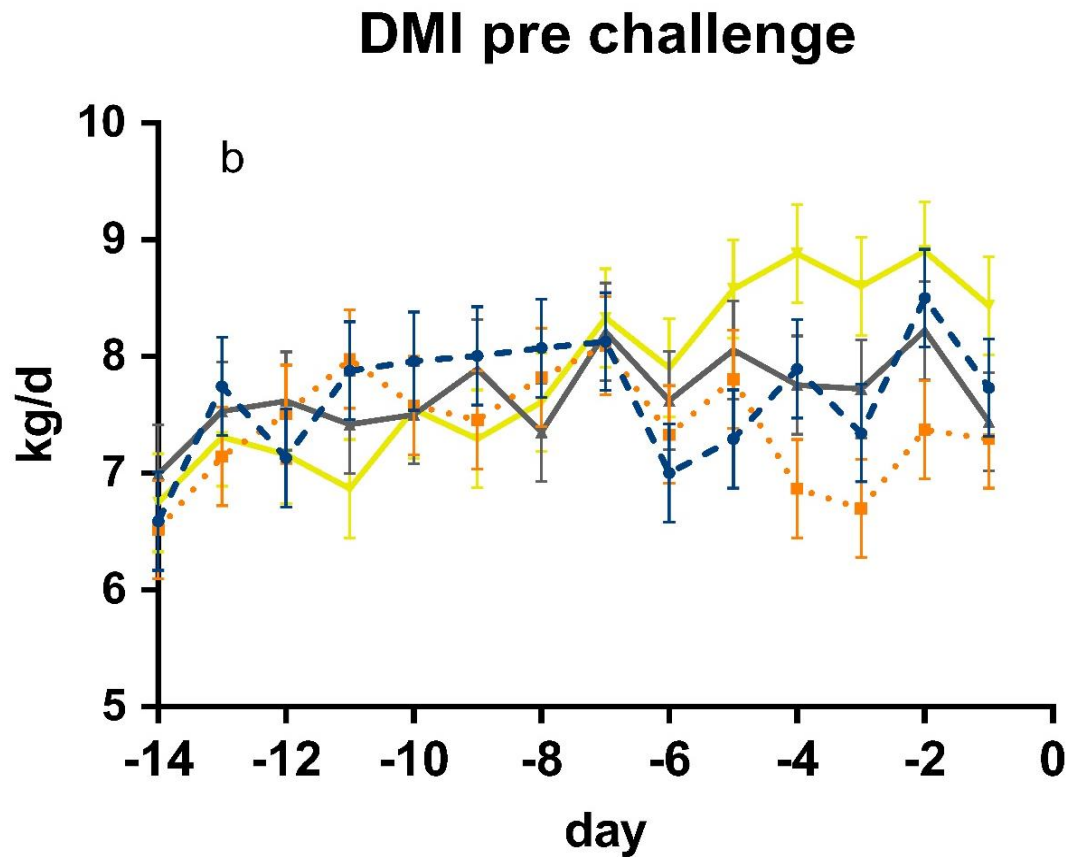
On days of challenge, right before LPS infusion



Intravaginal temperature, recorded every 5 min

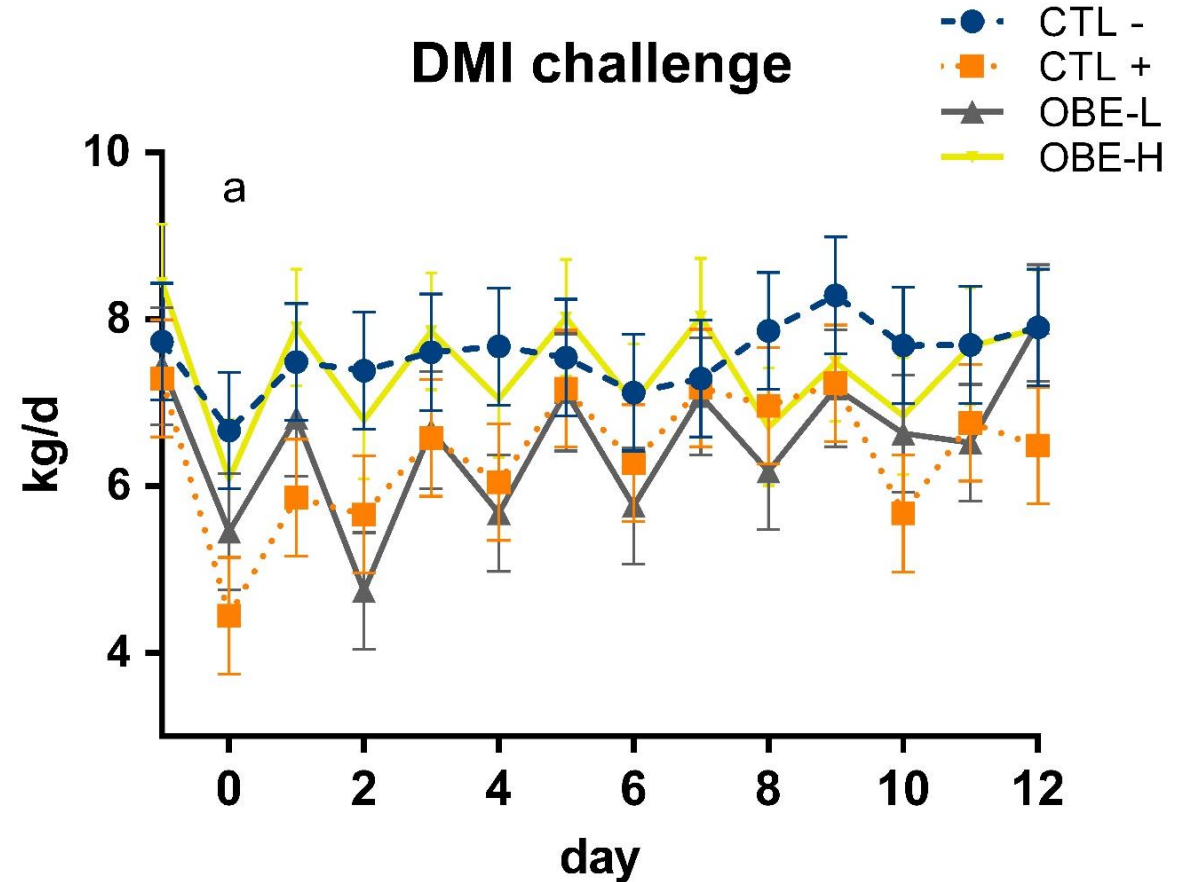
 **LPS challenge**

# No differences observed on DMI pre-challenge



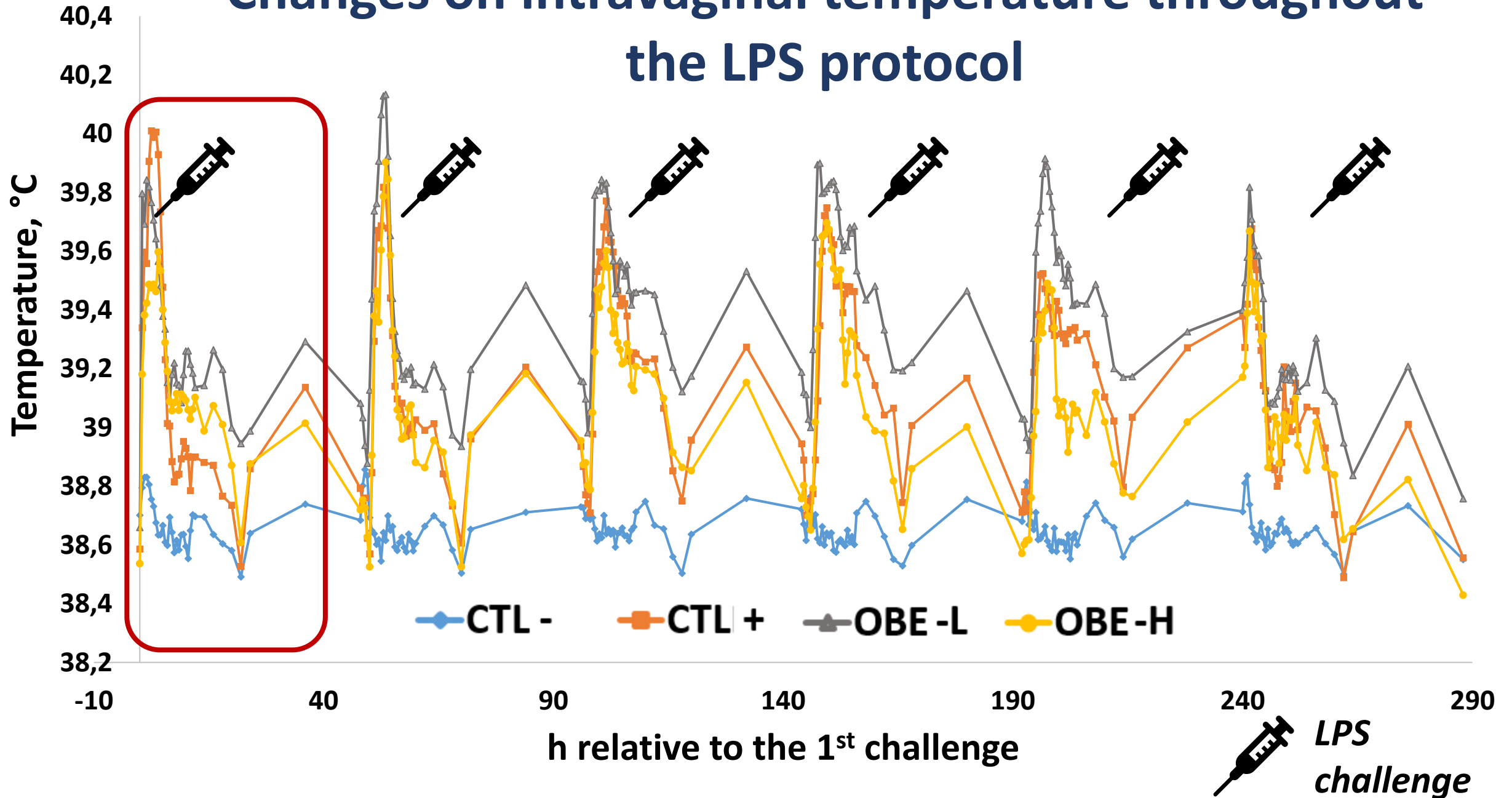
Trt,  $P = 0.84$

# OBE supplementation improved DMI on animals exposed to LPS

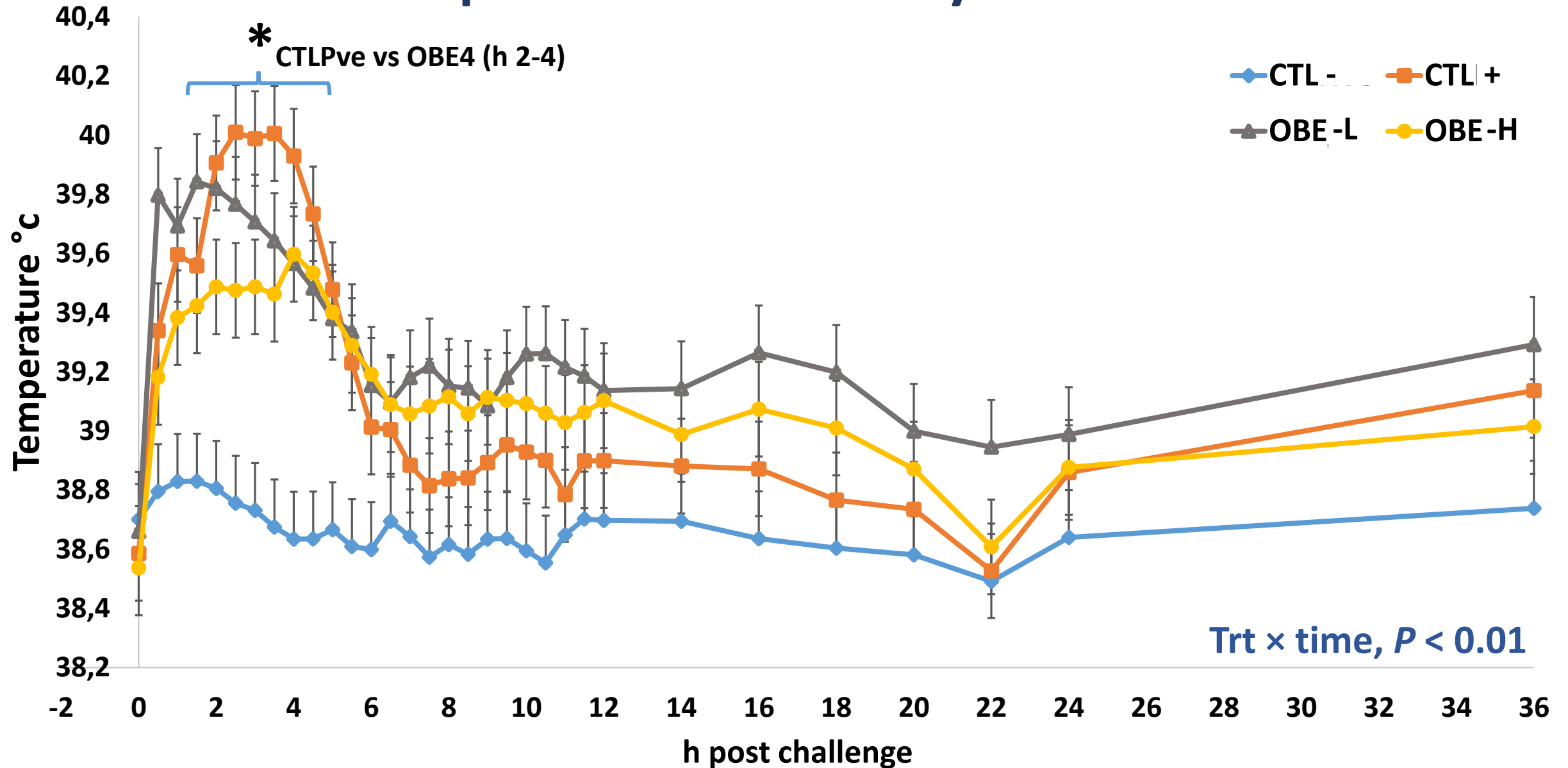


Trt  $\times$  day,  $P = 0.05$

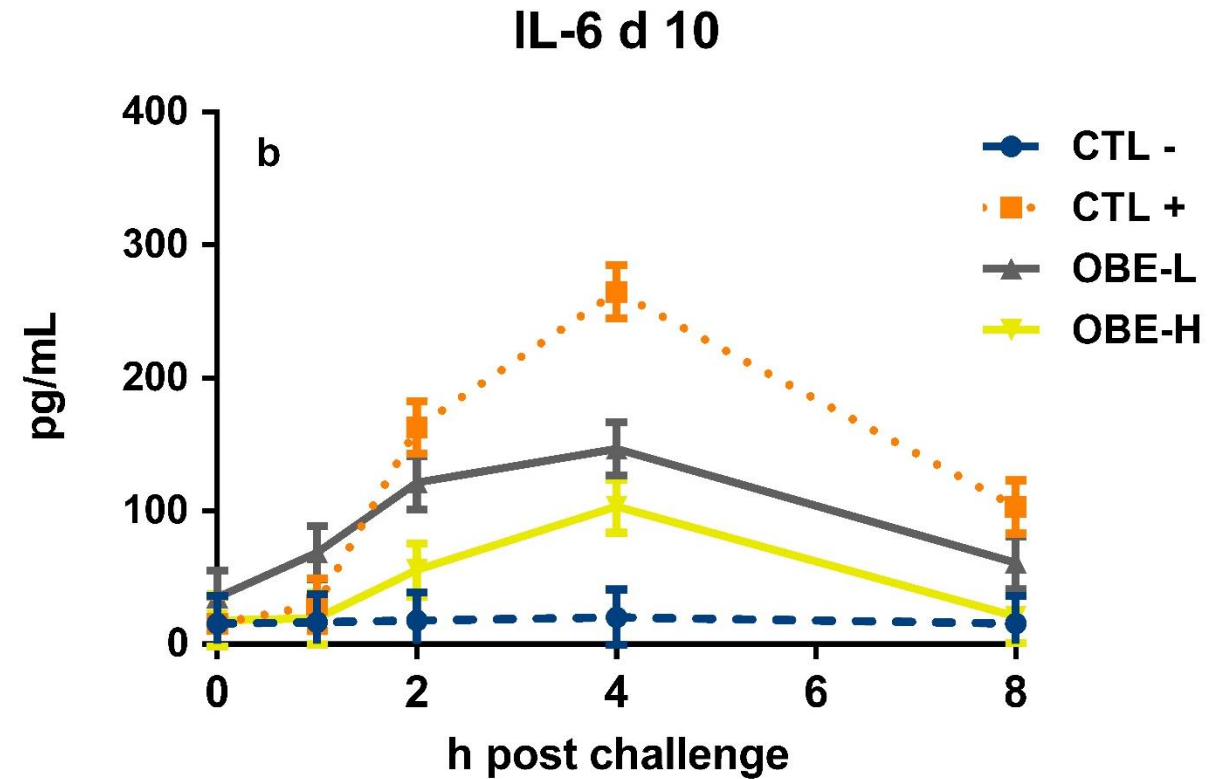
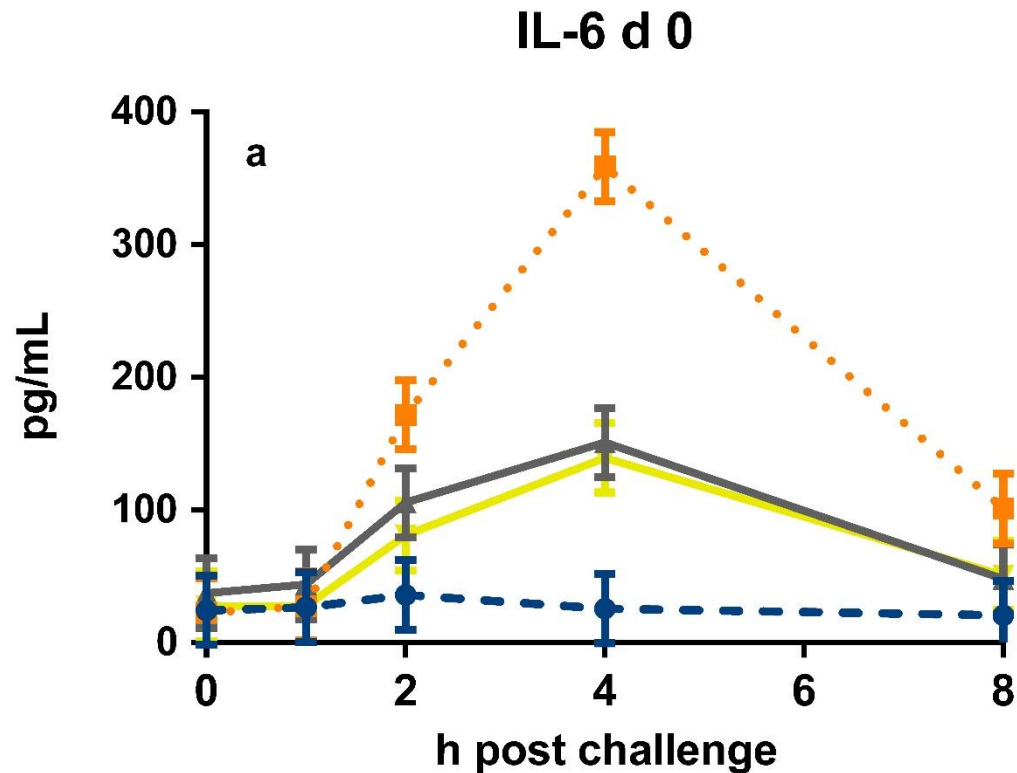
# Changes on intravaginal temperature throughout the LPS protocol



# OBE-H supplementation decreased the rise on intravaginal temperature induced by LPS on d 0



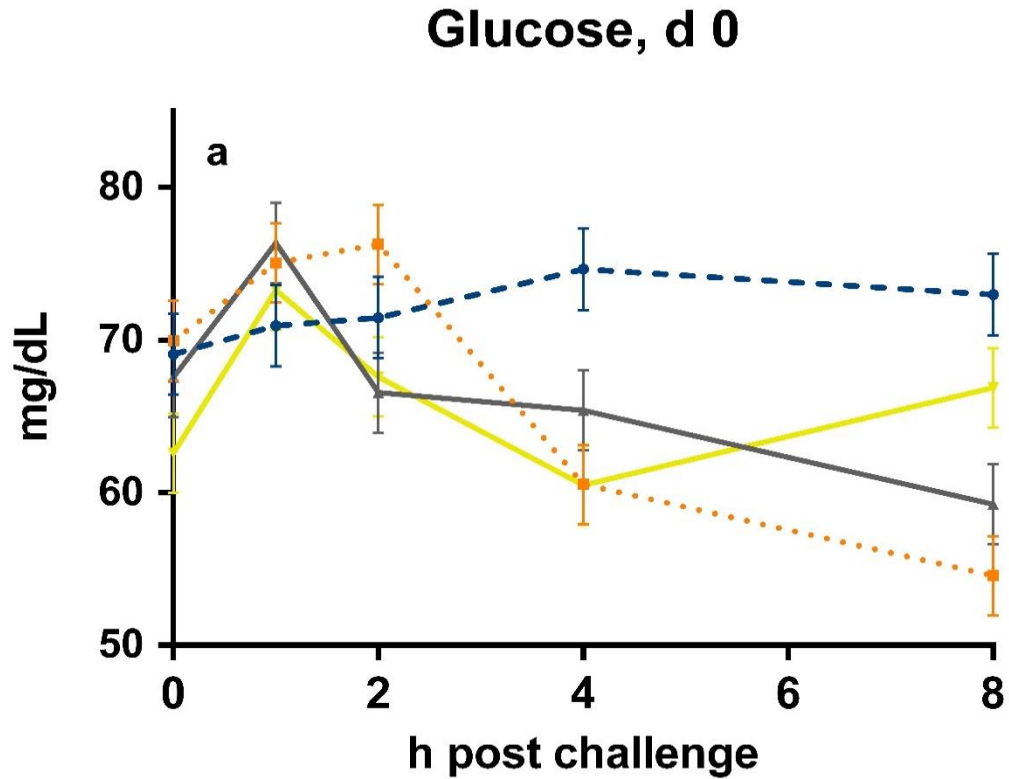
# Heifers supplemented with OBE ameliorated the increased in IL-6 induced by LPS



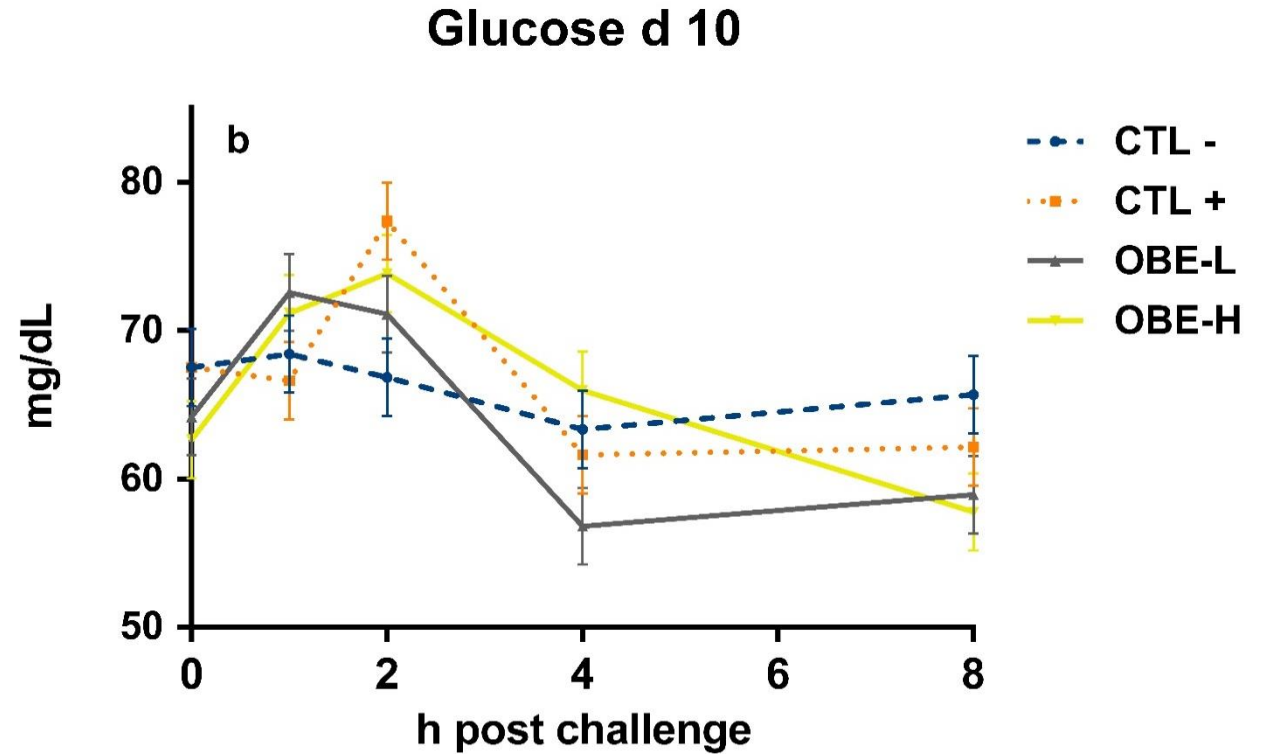
Trt × time,  $P < 0.01$

Trt × time,  $P < 0.01$

# Heifers supplemented with OBE-H recovered normal glycemia faster on d 0 but not on d 10



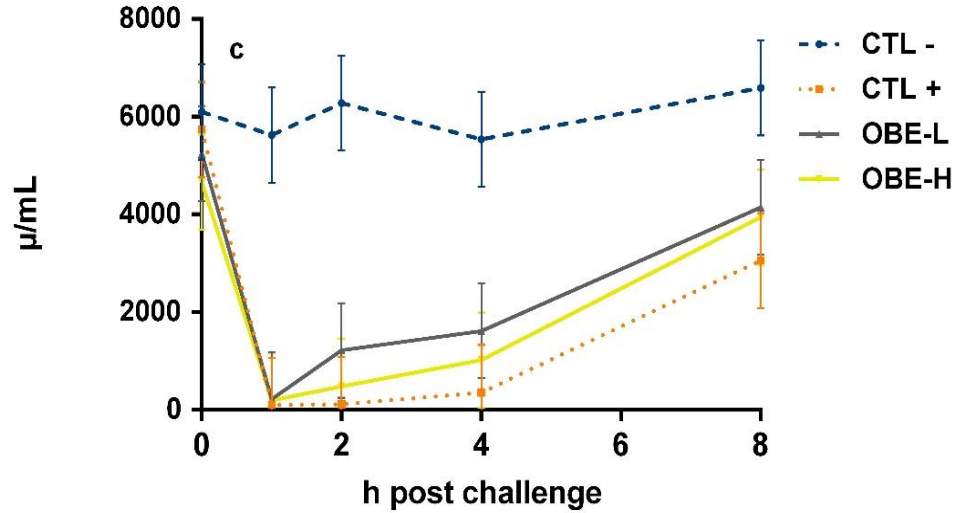
Trt × time,  $P = 0.02$



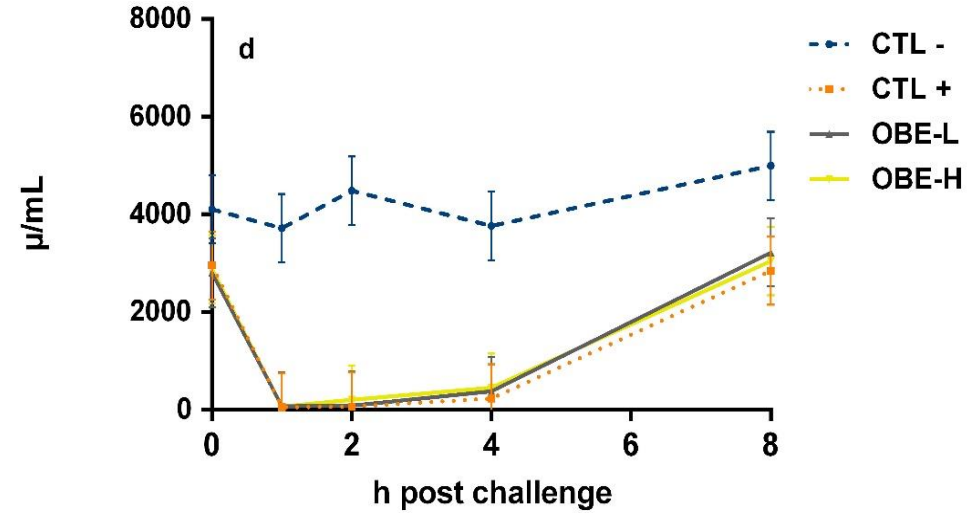
Trt × time,  $P = 0.29$

# OBE recovered normal neutrophils cell counts faster than CTL +

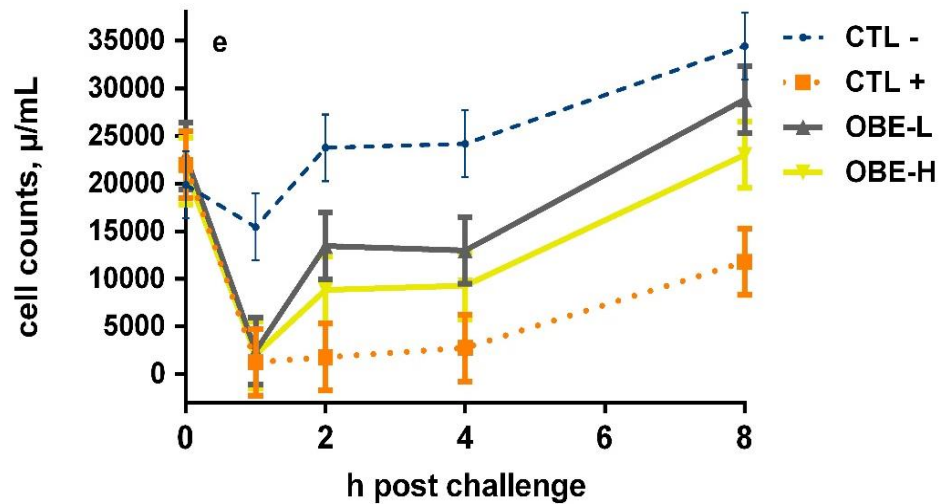
Monocytes cell counts d0



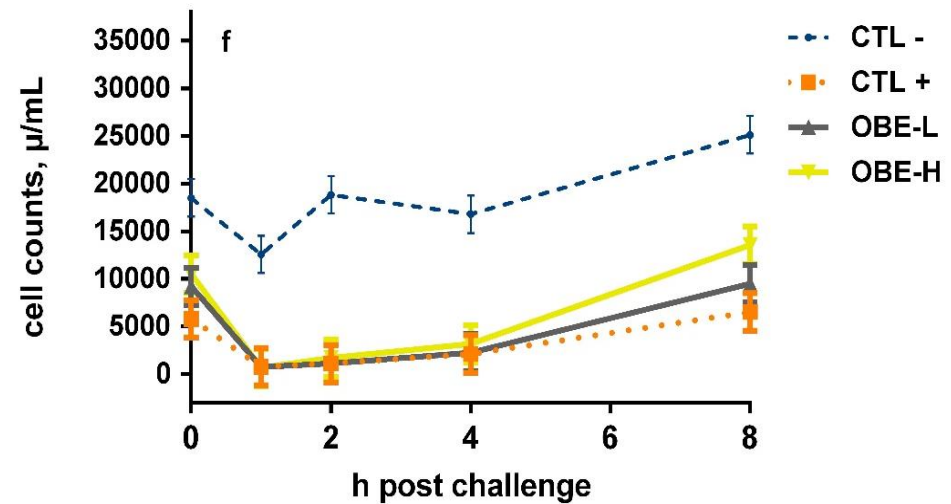
Monocytes cell counts d10



Neutrophils cell counts d 0

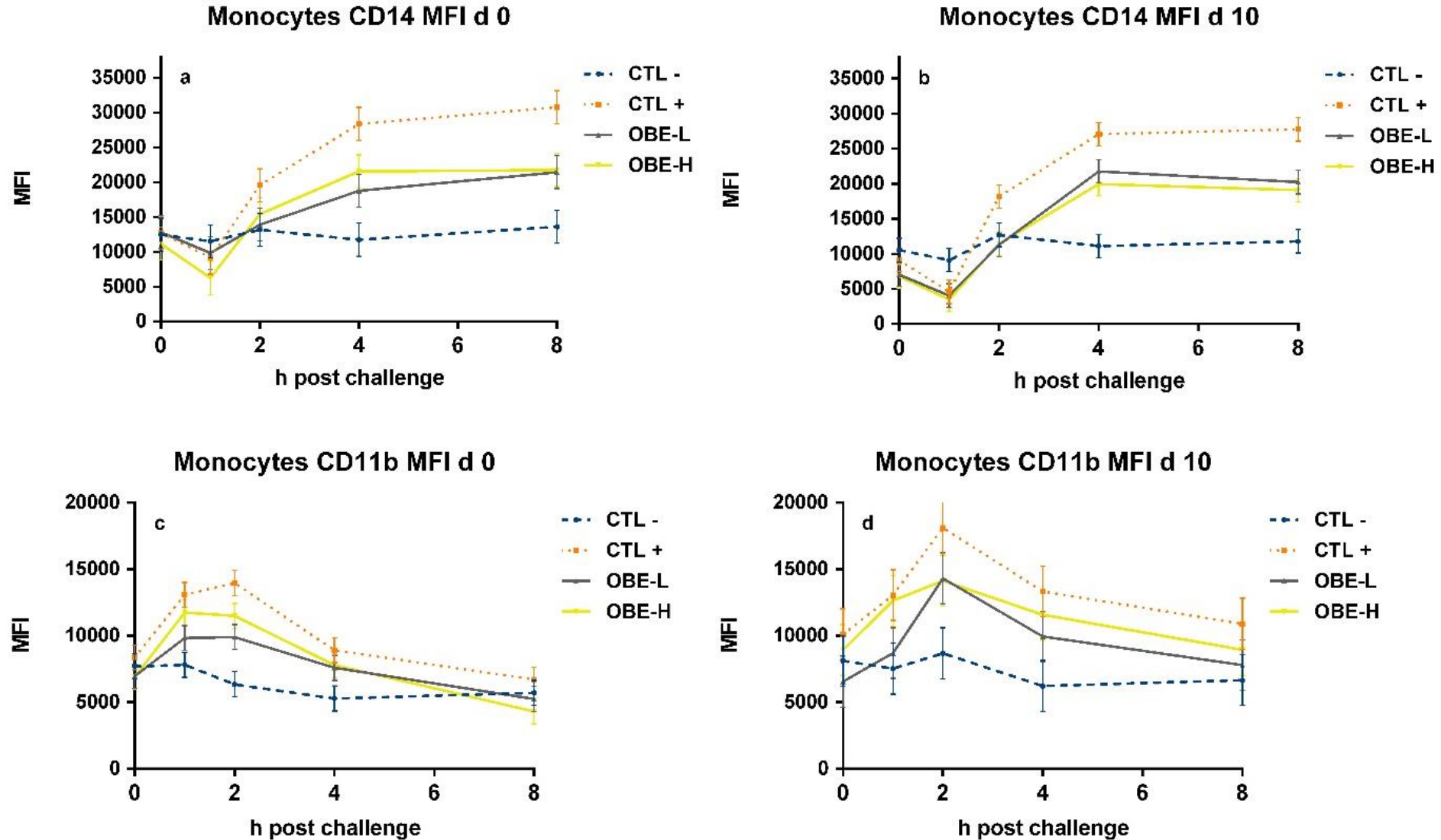


Neutrophils cell counts d 10

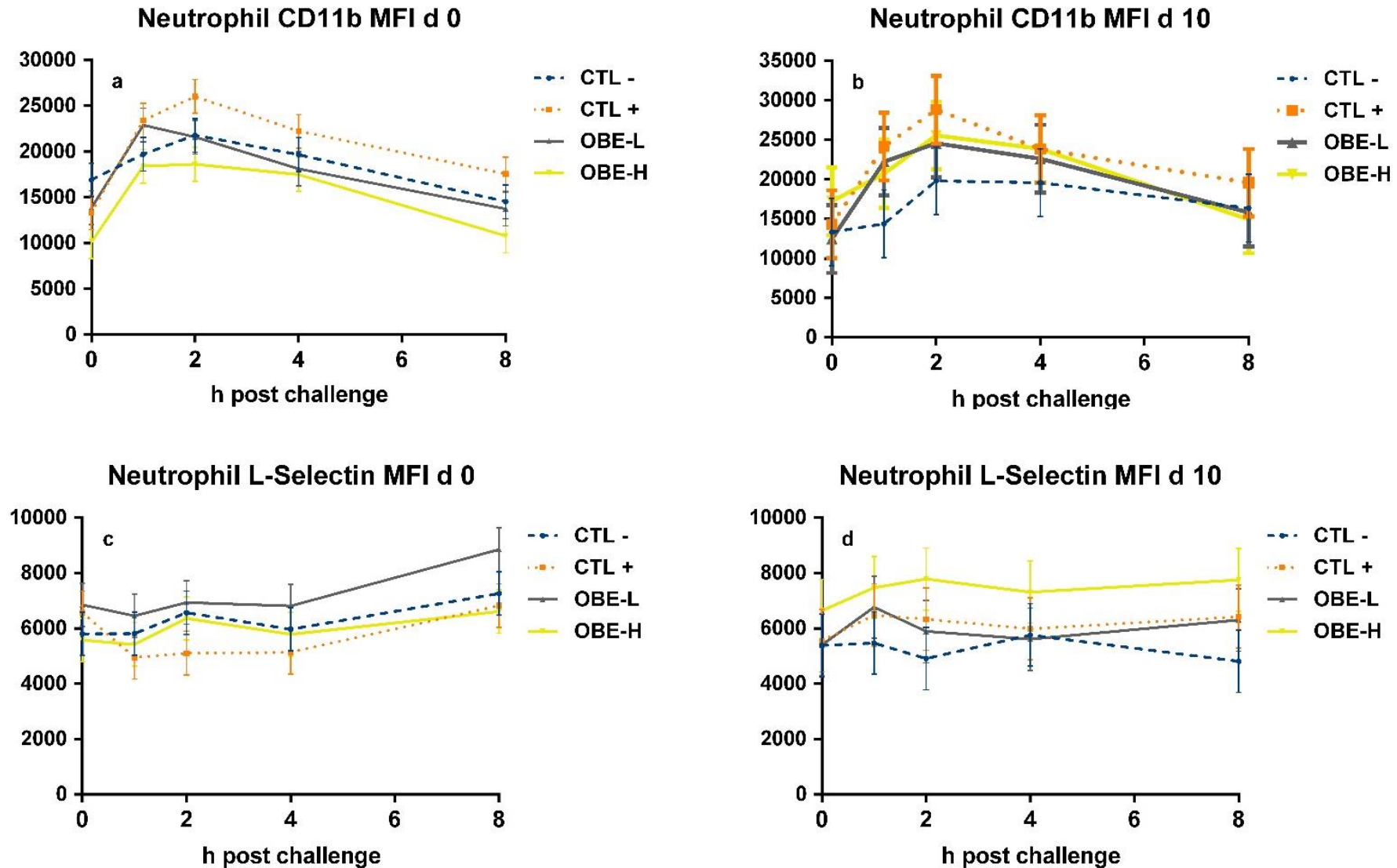




# OBE supplementation downregulated the expression of CD14 and CD11b on monocytes cell surface



# Heifers supplemented with OBE had reduced expression of CD11b in neutrophils



# Conclusions

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- **Supplementation with OBE**
  - **Ameliorated some of the negative effects of LPS on:**
    - **Dry matter intake**
    - **Intravaginal temperature °C**
    - **Inflammatory marker concentration**
- **Recover normal glycemia faster on the first day of challenge**
- **Modulated the immune response by ameliorating the drop on immune cell counts, and reducing expression of cell surface receptors involved in LPS recognition and cell migration**

# Acknowledgements

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## Committee members

- Dr. Nicolas DiLorenzo
- Dr. Ignacio Ipharraguerre
- Dr. Jose Dubeux
- Dr. Jeong Kwang Cheol
- Dr. Corwin Nelson

## Beef unit crew

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- Tessa Schulmeister
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- Manuel Pena