



## ➤ Alpine goats divergent for functional longevity differ in metabolic profile during transition period

**Pires J.<sup>1</sup>, Fassier T.<sup>2</sup>, Turrett M.<sup>1</sup>, Huau C.<sup>3</sup>, Friggens N. C.<sup>4</sup>, Rupp R.<sup>3</sup>**

<sup>1</sup>INRAE, Université Clermont Auvergne, Vetagro Sup, UMRH, Saint-Genès-Champanelle, 63122 France

<sup>2</sup>Domaine de Bourges, INRAE, Osmoy, 31326 France

<sup>3</sup>GenPhySE, Université de Toulouse, INRAE, Castanet Tolosan, 31320 France

<sup>4</sup>UMR 0791 MoSar, INRAE, AgroParisTech, Université Paris-Saclay, Paris, 75005 France

[jose.pires@inrae.fr](mailto:jose.pires@inrae.fr)



## ➤ Outline

- Short introduction
- Objectives
- Experimental design / Measurements / Statistical Analyses
- Results
  - Effects of longevity strain (**LGV+** vs **LGV -**)
  - Effects of pregnancy type (**Single** vs **Multiple** fetus)
  - Incidence of BHB > 0.80 mM during late gestation
- Conclusions

## ➤ Introduction

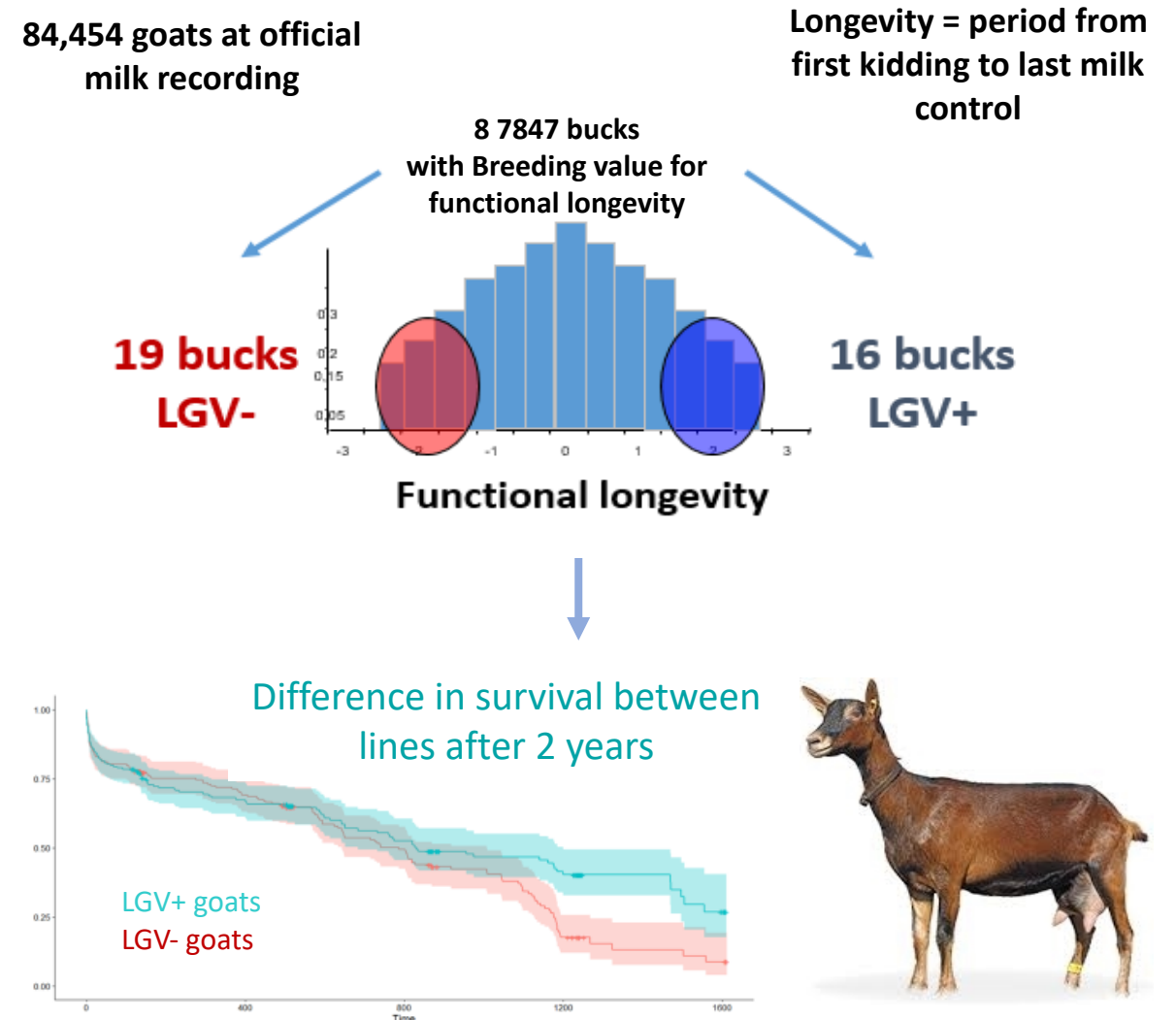
- Dairy production systems must improve resilience to cope with climate change and inherent variability in feed resources.
- The periparturient period requires coordinated metabolic adaptations.
- Differences in adaptive capacities during transition period may explain individual differences in resilience and functional longevity.
- Alpine goat strains divergent for functional longevity show differences in BW and fat-to-protein ratio during early lactation:
  - Indicating potential differences in body reserves and resource allocation during early lactation (Ithurbide et al., 2022)

## ➤ Objective

- To study associations among functional longevity and plasma indicators of metabolic adaptation in Alpine goats during periparturient period.

## ➤ Creation of the Alpine goat longevity strains

- National Genetic evaluation for functional longevity (Palhiere *et al.*, 2018)
- Selection of bucks with extreme EBVs for functional longevity but nondifferent milk yield
- Artificial insemination and creation of two Alpine goat strains (**LGV+** and **LGV-**) at INRAE facility P3R, Bourges



Source: Ithurbide et al. (2022)

## ➤ Experimental design

### Sampling and analyses

- A total of **174 primiparous 1-year old** goats
- **First lactation in 2018, 2019, 2020 and 2021.**
- Jugular plasma samples collected on:
  - wk -4, -3, -2, -1 relative to expected parturition
  - wk 1, 2, 4, 13, 24, 33 of lactation
- Plasma analyzed for NEFA, BHB, glucose, urea and bilirubin by enzymatic colorimetric methods.

Year	week										Total
	-4	-3	-2	-1	1	2	4	13	22-24	33	
2018	34		34	34	34	34		33			
2019	52	52	52	52	46	34	34	51	51	51	
2020	41		41	41	35	35	32	30	29	29	
2021	41	42	42	42	38	44	44	43	43	42	
<b>Total</b>	168	94	169	169	153	147	110	157	123	122	1412

# ➤ Statistical analyses

## Performed separately to assess :

1. the effects of longevity strain (**LGV+** vs **LGV -**), primiparous goats
2. the effects of pregnancy type (**Single** vs **Multiple** fetus), primiparous goats.

## Repeated measures using Proc Mixed of SAS

- **Fixed effects**
  1. Strain, week, strain\*week
  2. Preg, week, preg\*week
- **Random effects**
  - Goat(Year) , Year
- **Repeated measures**
  - repeated week/ subject=goat(year)
  - SP(POW)

## Chi-square or Fisher tests for contingency tables

- incidence of plasma BHB > 0.80 mM during late gestation

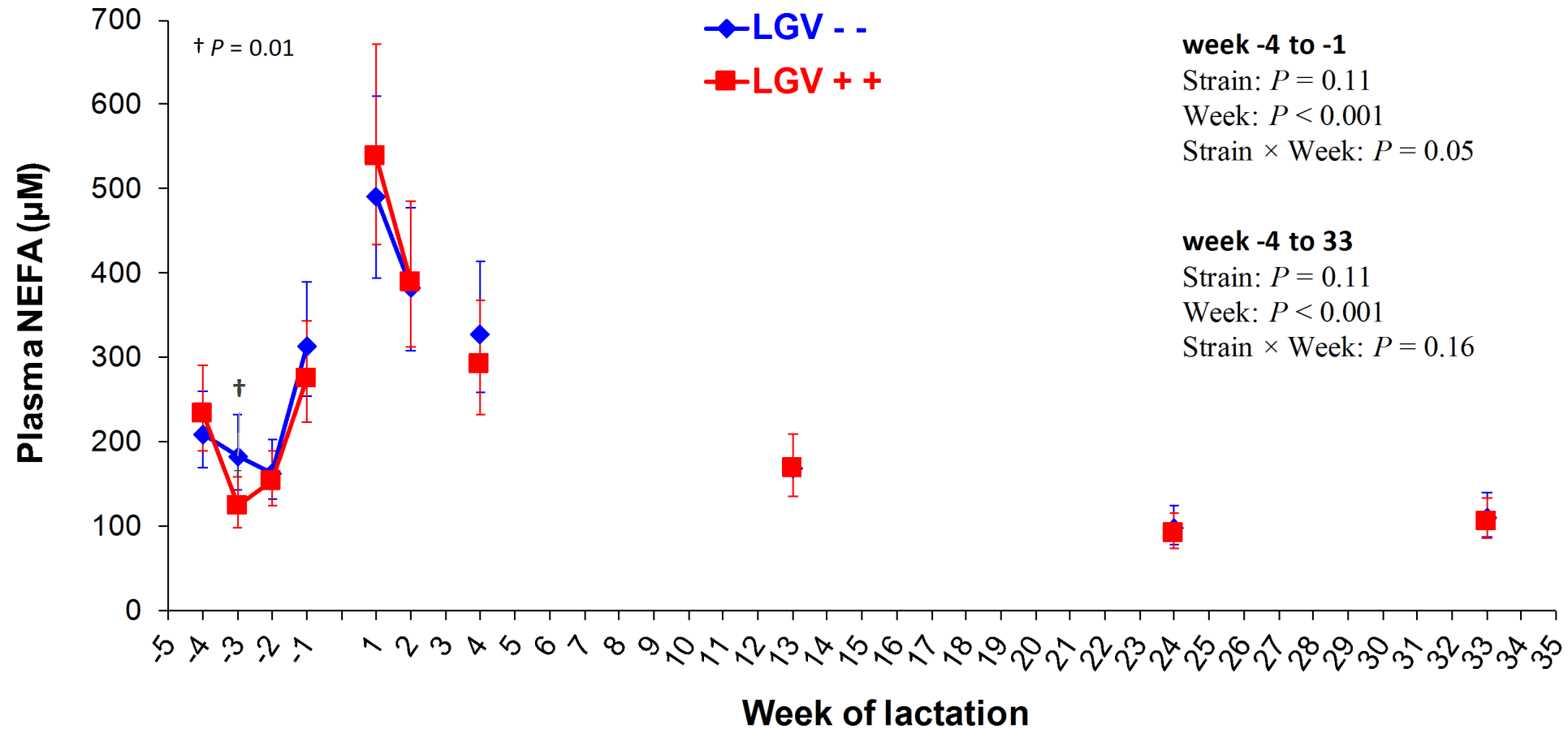
## ➤ Results

- Effects of longevity strain (**LGV+** vs **LGV -**)



## ➤ Strain effects (2018-2021)

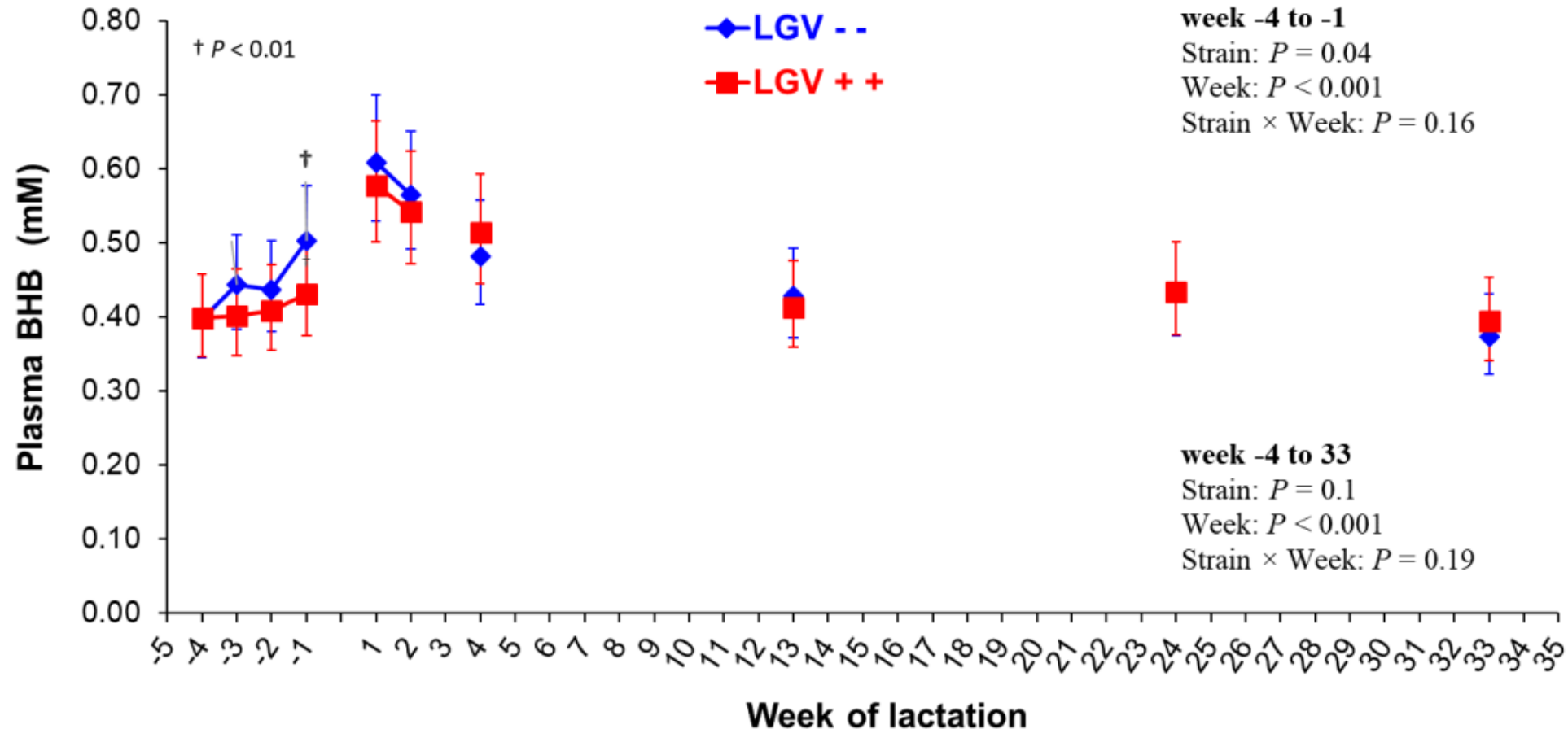
LGV- goats had greater plasma NEFA on wk-3 (181 vs 123  $\mu\text{M}$ )  
 -> greater FA mobilization



(LSMEANS and 95%CI; n = 169 to 174; Symbols = « slice effects » using wk-4 to +33 model)

## ➤ Strain effects (2018-2021)

LGV- goats had greater plasma BHB prepartum (0.45 vs 0.41 mM)  
 -> greater FA mobilization and oxidation



(LSMEANS and 95%CI; n = 169 to 174; Symbols = « slice effects » using wk-4 to +33 model)

## ➤ Results

- Effects of pregnancy type (**Single** vs **Multiple** fetuses)

## ➤ Pregnancy type: Single vs Multiple

35% of goats carried multiple fetuses

Not different between LGV strains

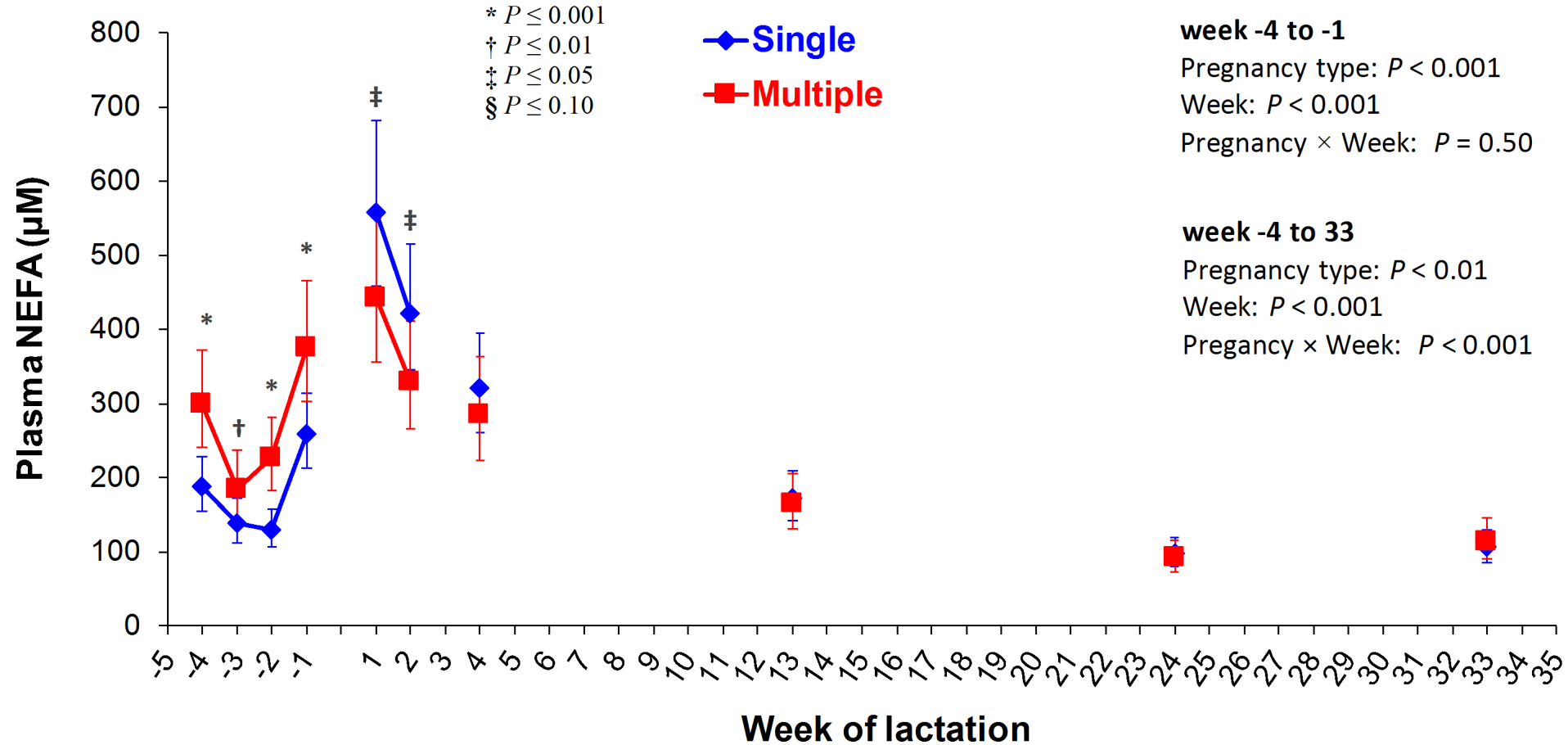
- During **late gestation**, goats carrying **multiple** fetuses had:
  - Greater plasma NEFA, BHB and bilirubin
  - Lower plasma glucose
- During **early lactation**, goats that had carried **single** fetus had:
  - Greater plasma NEFA

## ➤ Pregnancy type: Single vs Multiple (2018-2021)

Late gestation plasma NEFA was greater for **Multiple**  
 Early lactation plasma NEFA was greater for **Single**

-> greater FA mobilization

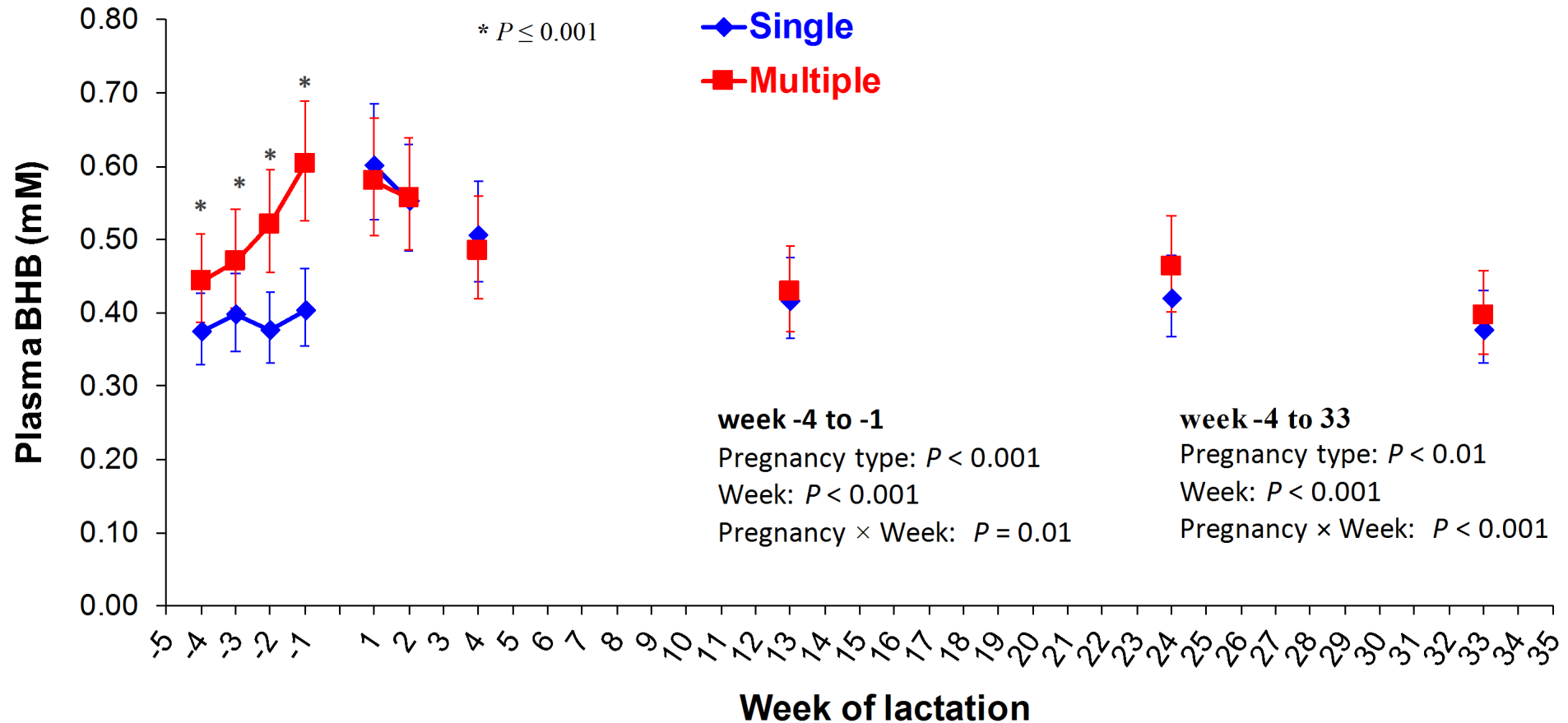
-> more body reserves (?) and FA mobilization



(LSMEANS and 95%CI; n = 169 to 174; Symbols = « slice effects » using wk-4 to +33 model)

# ➤ Pregnancy type: Single vs Multiple (2018-2021)

Late gestation plasma BHB was greater for **Multiple** -> greater FA mobilization + partial oxidation



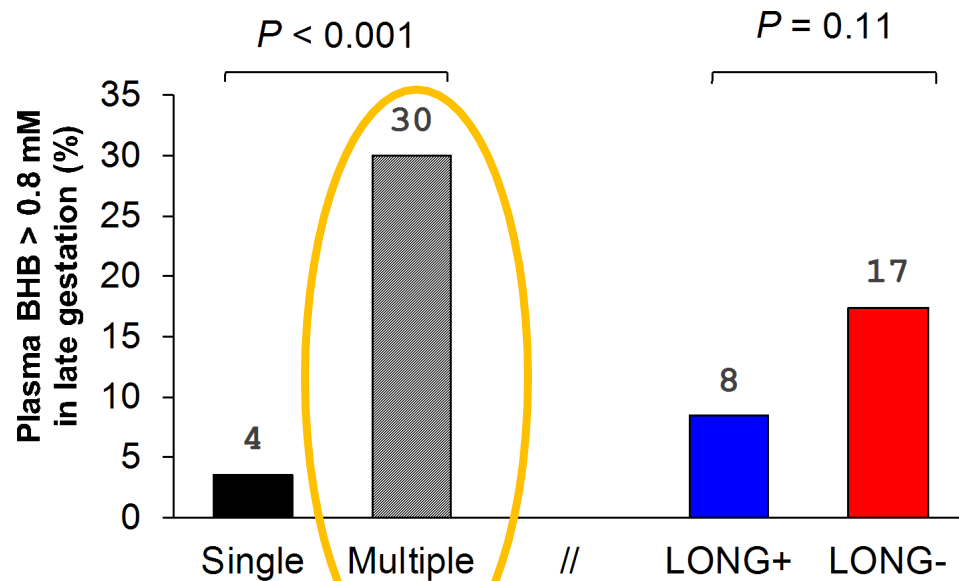
(LSMEANS and 95%CI; n = 169 to 174; Symbols = « slice effects » using wk-4 to +33 model)

## ➤ Results

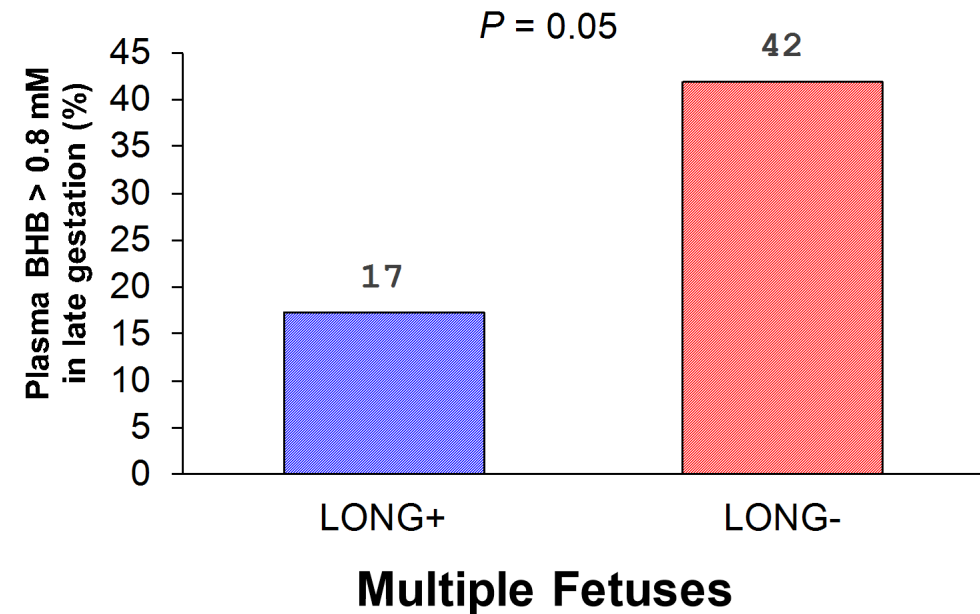
- Incidence of BHB > 0.80 mM during late gestation

## ➤ Incidence of BHB > 0.80 mM during late gestation

Threshold associated with increased odds of early removal from a commercial herd ( $\leq 30$  DIM)  
(Zamuner et al. 2020)



Incidence of BHB > 0.80 mM was greater for goats carrying multiple than single fetus (30 vs 4%)



Incidence was greater for LGV- than LGV+ (42 vs 17%) within goats carrying multiple fetuses



## ➤ Conclusions

- Marked pregnancy type effects (Single vs Multiple fetuses) were observed in plasma metabolite profiles of primiparous goats.
- Alpine goat strains divergent for LGV differ in their metabolic adaptations peripartum.
  - As seen in goats under metabolic stress induced by carrying multiple fetuses during late gestation.
- Metabolic robustness during the transition period is associated with functional longevity in our experimental model

➤ Thank you