



The 75th EAAP Annual Meeting

1/5 September 2024 - Florence, Italy



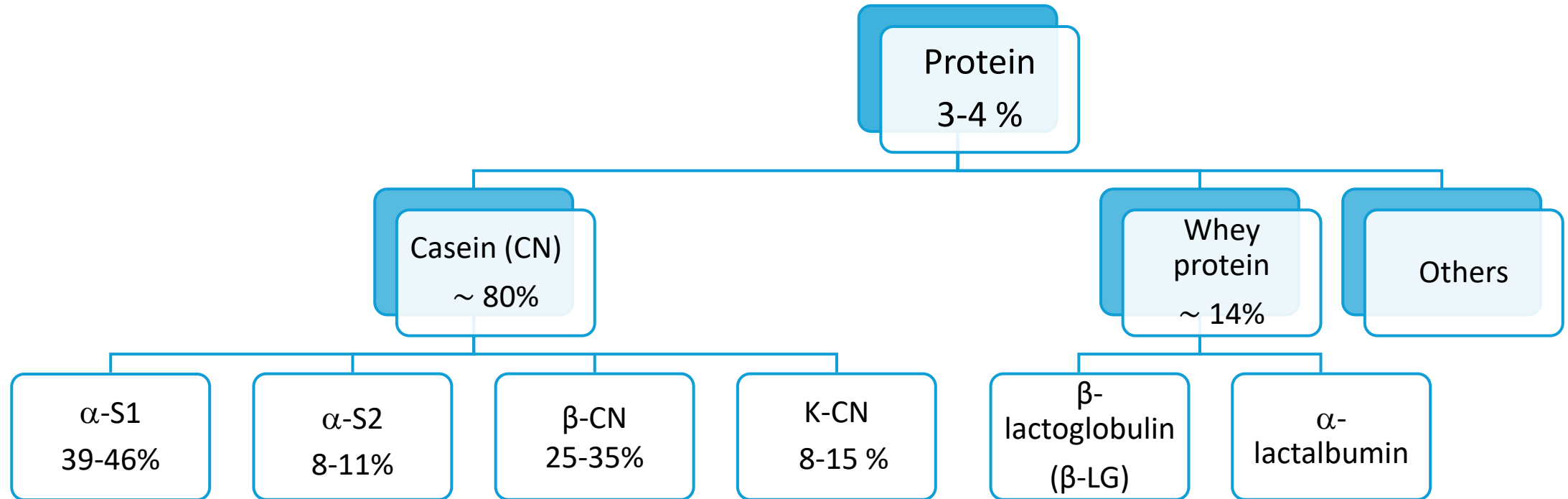
Does breeding for A2 cows alter milk yield and composition?

Suha Serhan, Carmen L. Manuelian, Ahmed A. K. Salama, Gerardo Caja, Xavier Such

Universitat Autònoma de Barcelona (UAB), Group of Ruminant Research, Dept. Animal and Food Science, Travessera del Turons, 08193 Bellaterra, Barcelona, Spain

Introduction

Milk protein



Introduction

Milk protein polymorphism: β -CN, κ -CN, and β -LG

β -CN	κ -CN	β -LG
		
☐ A1	☐ A	☐ A
☐ A2	☐ B	☐ B
☐ A3	☐ B2	
☐ A4	☐ C	
☐ B	☐ E	
☐ C	☐ F1	
☐ D	☐ F2	
☐ E	☐ G1	
☐ F	☐ G2	
☐ G	☐ H	
☐ H1	☐ I	
☐ H2	☐ J	
☐ I		
☐ J		
☐ K		

Gazi et al. (2022)
Daniloski et al. (2022)
Juan et al. (2024)

Introduction

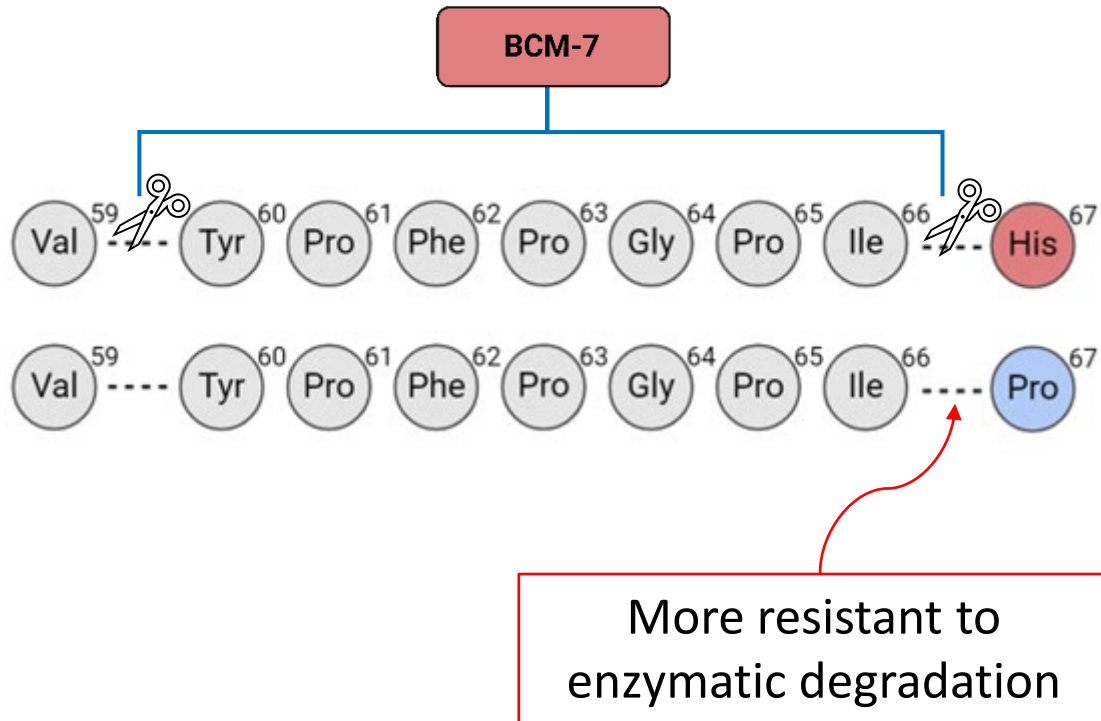
Milk protein polymorphism: β -CN, κ -CN, and β -LG

β -CN	κ -CN	β -LG
☒ A1	☒ A	☒ A
☒ A2	☒ B	☒ B
☐ A3	☐ B2	
☐ A4	☐ C	
☐ B	☒ E	
☐ C	☐ F1	
☐ D	☐ F2	
☐ E	☐ G1	
☐ F	☐ G2	
☐ G	☐ H	
☐ H1	☐ I	
☐ H2	☐ J	
☐ I		
☐ J		
☐ K		

Gazi et al. (2022)
Daniloski et al. (2022)
Juan et al. (2024)

Introduction

A1 vs A2 variant digestion: β -casomorphin-7 (BCM-7)



Nguyen et al. (2015)
Sebastiani et al. (2020)
Daniloski et al. (2021)
Juan et al. (2024)

Health Implications of BCM-7



GASTROINTESTINAL
TRACT



NEUROLOGICAL
DISORDER



CARDIOVASCULAR
DISEASES



DIABETES

Objective

Evaluate the effect of A1 and A2 β -CN variants on milk yield and composition (protein, fat, and SCC) in Holstein Friesian cows, controlling for κ -CN and β -lactoglobulin (β -LG) variants.



Materials and Methods

Data collection and cleaning

Data were collected from **6 farms**



43,893 obs.; 1,783 cows; 2010 – 2022
Monthly controls: **yield, protein, fat, SCC**

3,457 cows
Genetic information: **β -CN, κ -CN, β -LG**

DIM: 5 - 450 days
Herd-test-day: ≥ 3 animals
Cows : ≥ 3 obs. within lactation
Outliers: mean ± 3 SD

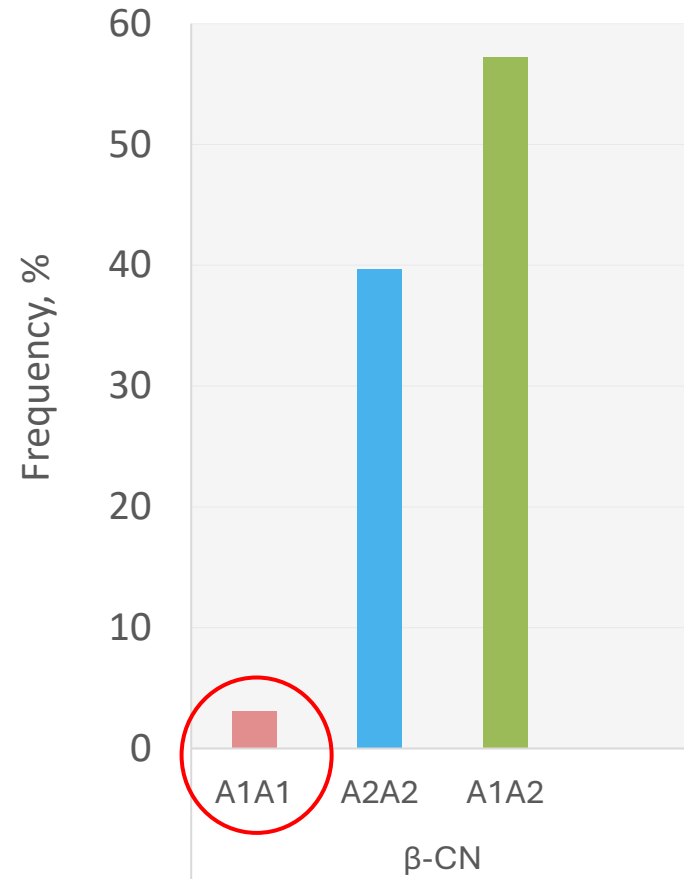
Final dataset
23,088 obs.; 1,233 cows; 2016-2022 (7 years)



Map of Spain

Materials and Methods

β -CN, κ -CN, and β -LG genotypes distribution



Linear mixed model using the PROC MIXED

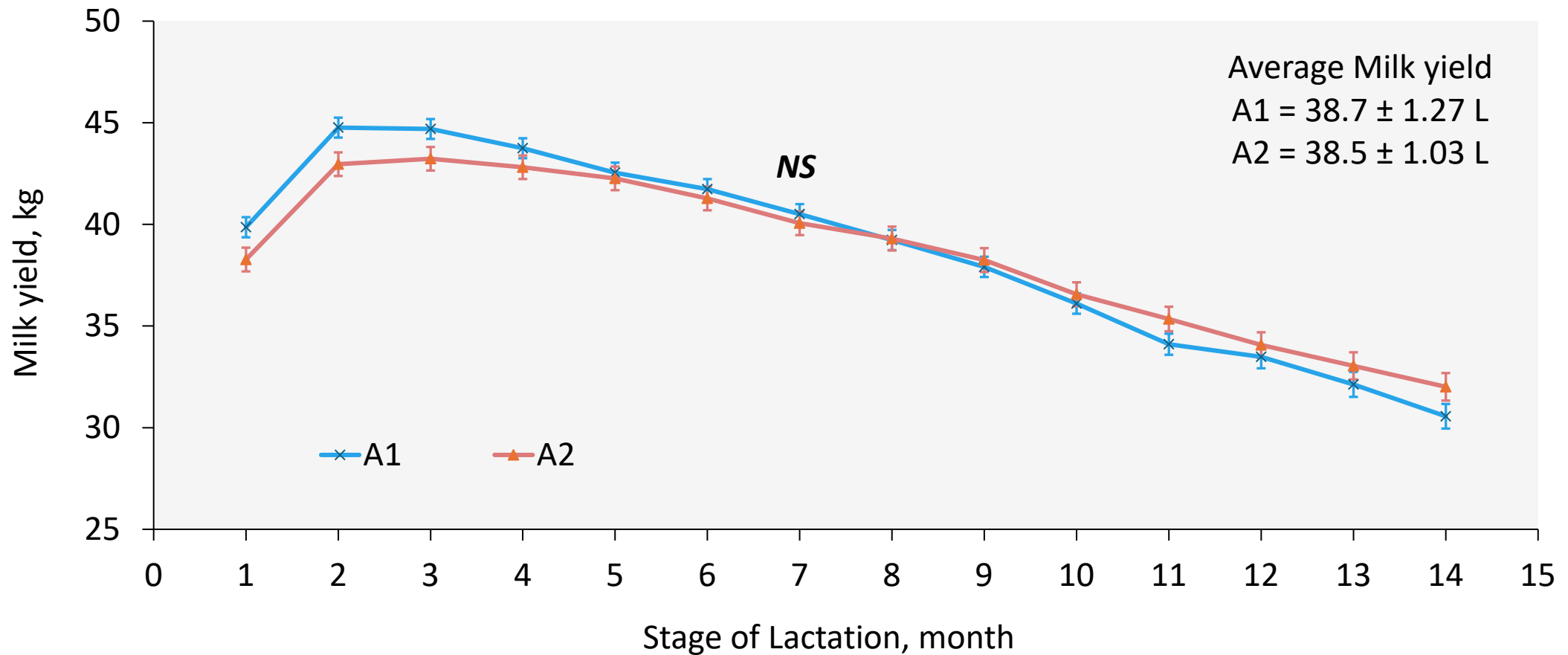
- Fixed effects:
 - β -CN (A1 and A2 family variant)
 - κ -CN (AA, AB, AE, BB, BE, and EE)
 - β -LG (AA, AB, and BB)
 - Parity class (1,2, and ≥ 3)
 - DIM class (1 to 14, each class being 30 DIM wide)
 - Calving season (autumn, winter, spring, summer)
 - Calving year (2016 to 2022)
 - Interaction of β -CN with parity class, DIM class, calving season, and calving year.
- Random effect: Animal nested within farm



Version 9.4

Results

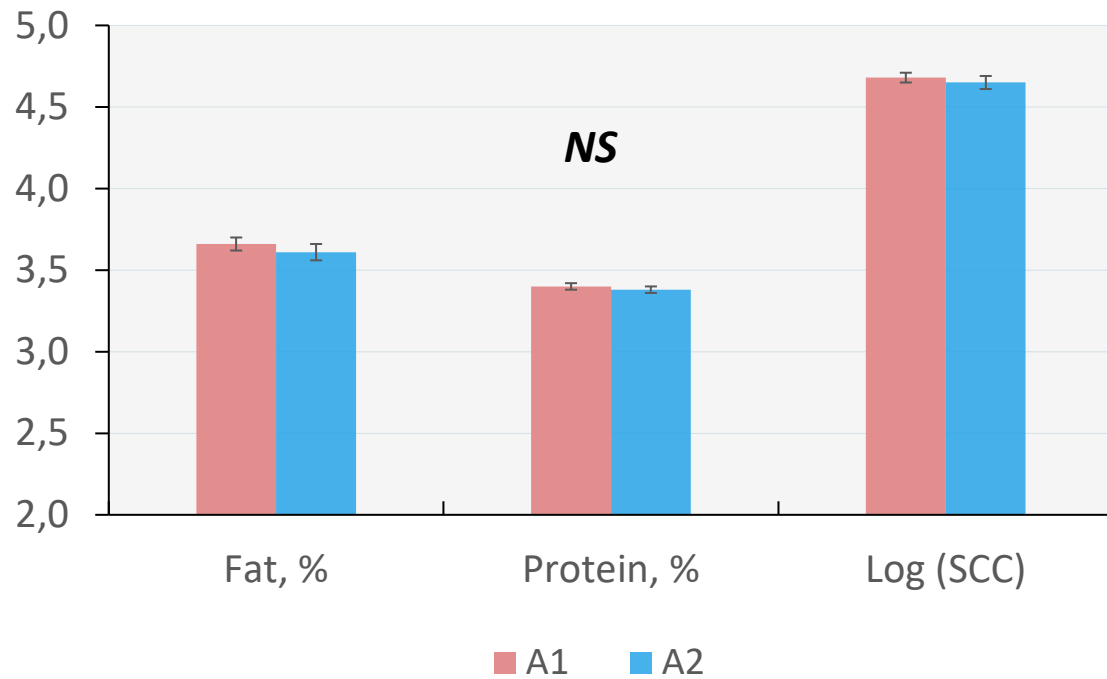
Lactation Curve (LS-Means $\pm$ SE) of A1 and A2 cows



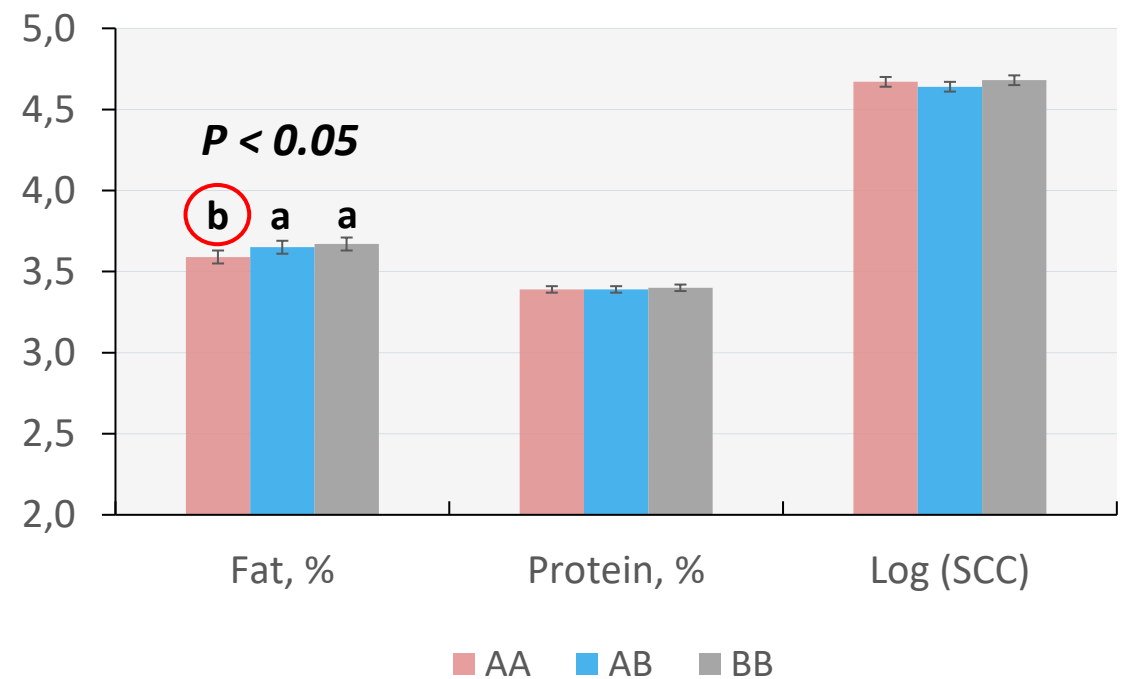
Results

LS-Means ($\pm$ SE) of milk composition of β -CN and β -LG genotypes

β -CN

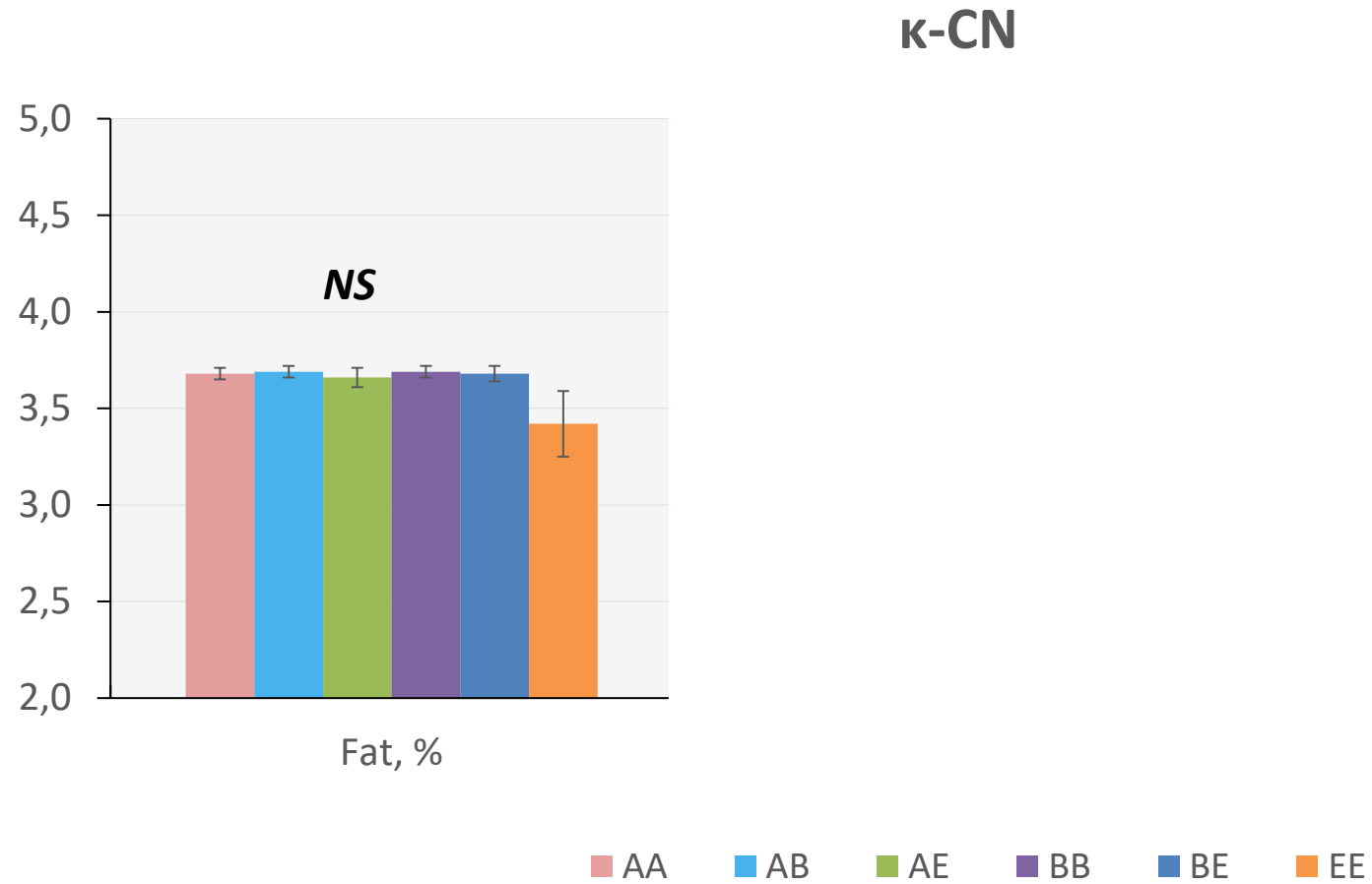


β -LG



Results

LS-Means ($\pm$ SE) of milk composition of κ -CN genotypes



Conclusions

β -CN

- No impact on milk yield and composition was observed.
- Breeding for A2 cows does not impair milk yield or composition.

κ -CN

- AA genotype correlated with lower protein content than BB genotype.
- Fat content and SCC were not influenced by κ -CN genotypes.

β -LG

- The AA β -LG genotype associated with lower fat content than BB genotype.
- Protein content and SCC were not affected by β -LG genotypes.

THANK YOU



UAB
Universitat Autònoma
de Barcelona

Acknowledgment

PID2019-110752RB-I00

