RESILIENCE TO ACUTE UNDERFEEDING IN DAIRY EWES DIVERGING IN FEED EFFICIENCY:

RUMEN DIMETHYL ACETAL COMPOSITION

Pablo G. TORAL[1]*, Susana ALVES[2], Rui J. B. BESSA[2], Pilar FRUTOS[1] and Gonzalo HERVÁS[1]

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WHAT? WHY? HOW?

RESILIENCE TO ACUTE UNDERFEEDING IN DAIRY EWES DIVERGING IN FEED EFFICIENCY: RUMEN DIMETHYL ACETAL COMPOSITION

RESILIENCE

WHAT?

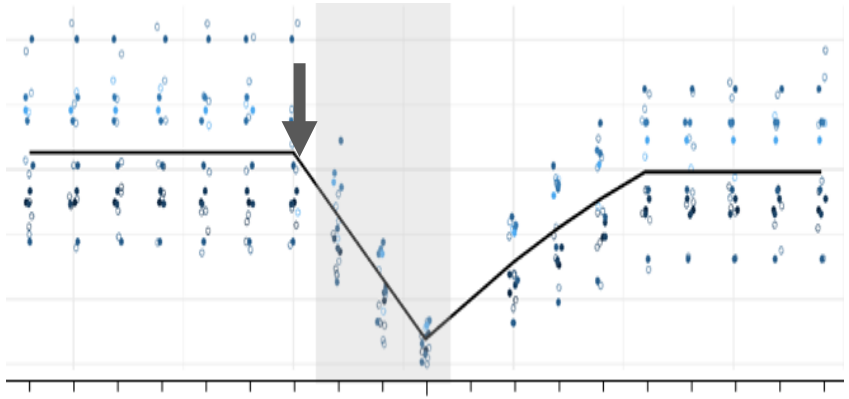
WHY?

HOW?

RESILIENCE

WHAT?

Ability to respond to a perturbation by reverting quickly to previous production level and health status



WHY?

HOW?

↓ Productivity

↑ Rusticity

↑ Resilience

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? Resilience

RESILIENCE

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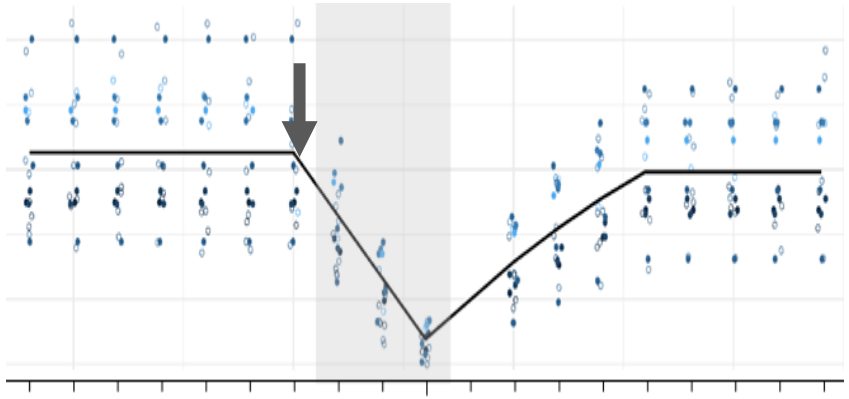


WHY?

↑ Nutritional challenges related to climate change and feed supply crises

HOW?

RESILIENCE

WHAT?

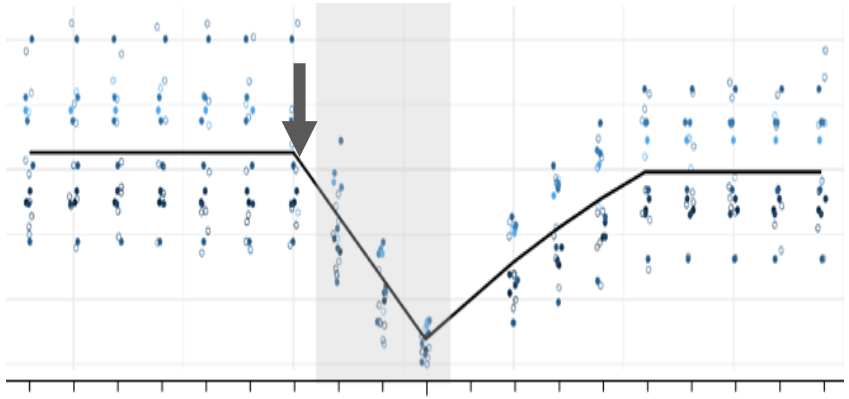
Ability to respond to a perturbation by reverting quickly to previous production level and health status

WHY?

↑ Nutritional challenges related to climate change and feed supply crises

HOW?

By simulating a feed supply crisis:
the ration is not available for 3 days



FEED EFFICIENCY

WHAT?

Ability to convert feed into milk (or meat)

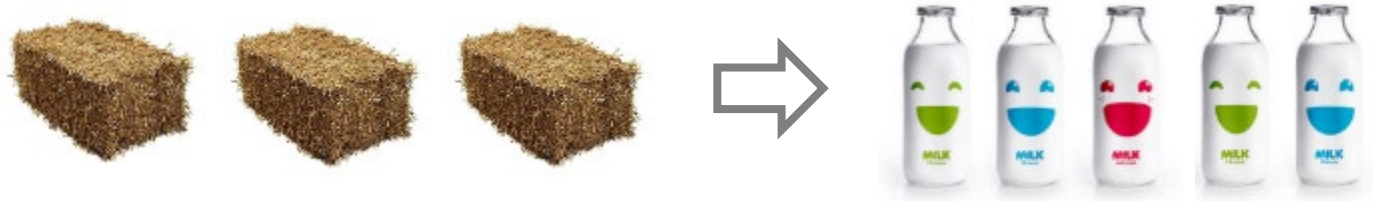
WHY?

HOW?

FEED EFFICIENCY

Current situation

High efficiency



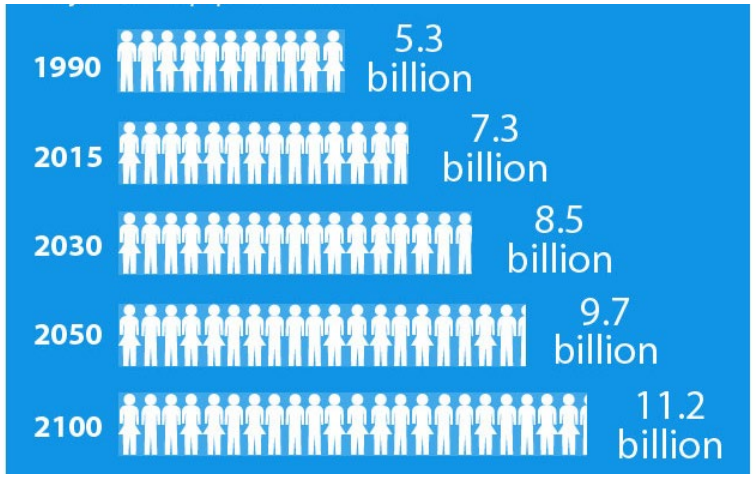
FEED EFFICIENCY

WHAT?

Ability to convert feed into milk (or meat)

WHY?

Ensuring food security for a growing population, while facing feed-food-fuel competition



HOW?

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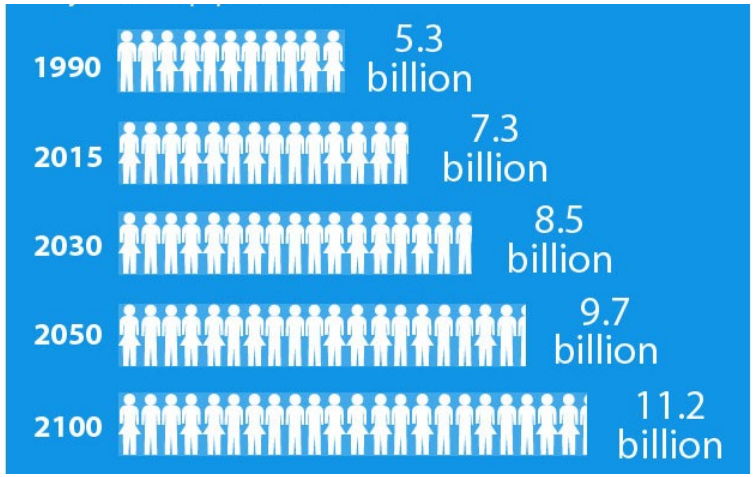
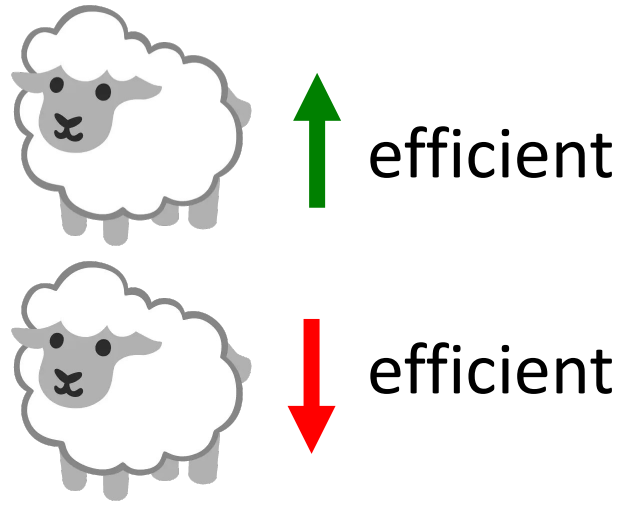


HOW?

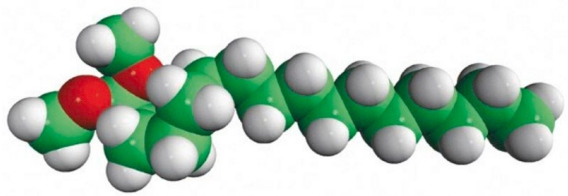
Selection of sheep phenotypically divergent for feed efficiency level



DIMETHYL ACETALS (DMA)

WHAT?

Microbial lipids containing vinyl (alk-1-enyl) ether chains



DMA-16:0

WHY?

HOW?

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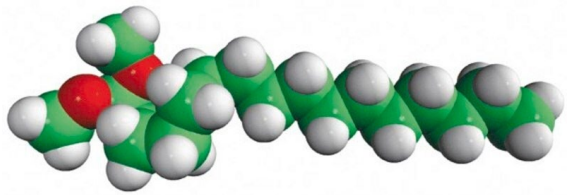

DMA-16:0

WHY?

Biomarkers of microbial condition, associated with the ability to be cope with environmental changes

HOW?

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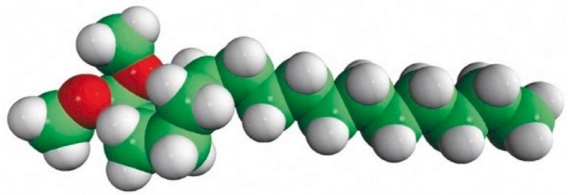


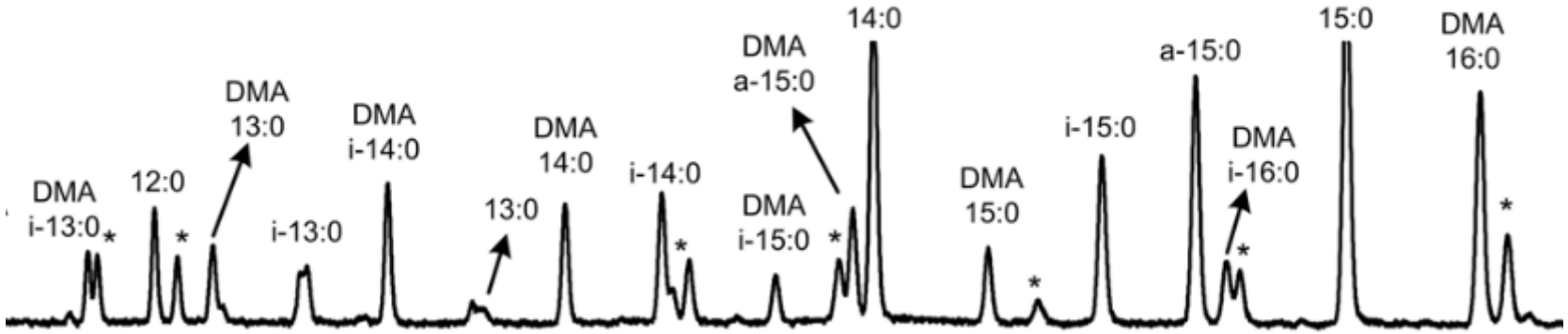
DMA-16:0

WHY?

Biomarkers of microbial condition, associated with the ability to be cope with environmental changes

HOW?

DMA elution during standard FAME analysis by GC



OBJECTIVE

To compare the pattern of variation of ruminal DMA in dairy sheep that are phenotypically divergent for feed efficiency and subjected to a nutritional challenge

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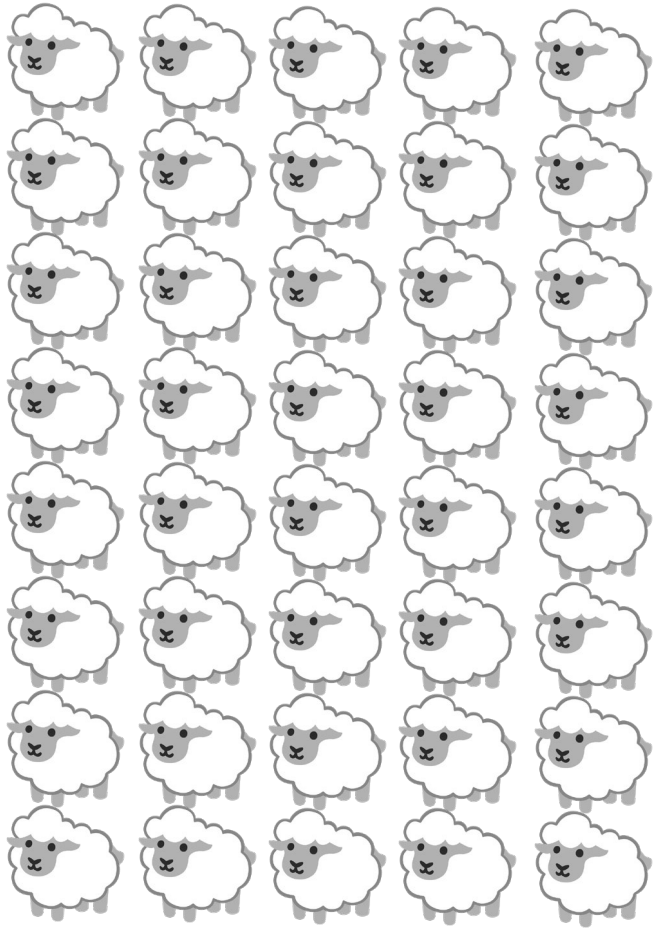
1. **Feed efficiency estimation**

2. **Nutritional challenge**

1. FEED EFFICIENCY ESTIMATION

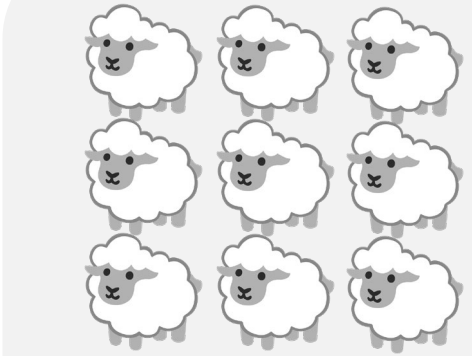


40 Assaf sheep
individual pens

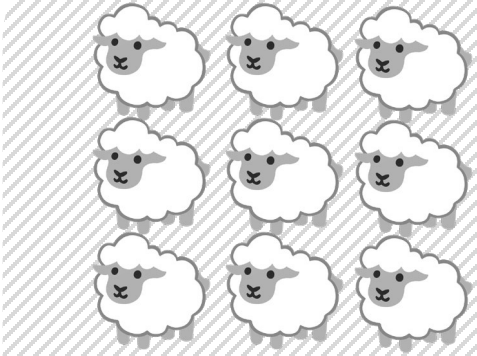
3 weeks

Feed intake
Milk yield
Milk composition
Body weight

$[FE = DMI_R - DMI_P]$



H-FE



L-FE

2. NUTRITIONAL CHALLENGE

Feed efficiency estimation (21 d)

Pre-challenge
ad libitum TMR

Challenge
STRAW

Post-challenge
ad libitum TMR

-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 1 2 3 4 5 6 7 8 9 10 day (within period)

Rumen fluid
stomach tube

2. NUTRITIONAL CHALLENGE

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STRAW

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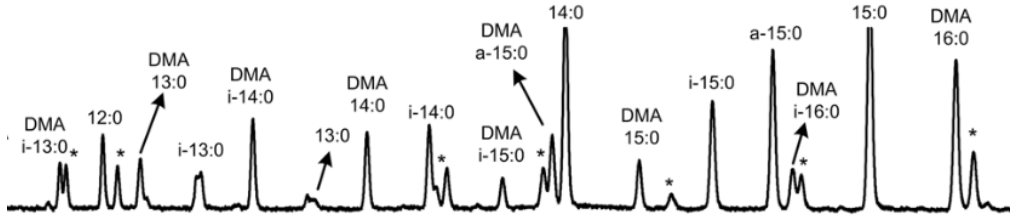
-8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 1 2 3 4 5 6 7 8 9 10 day (within period)

Rumen fluid
stomach tube

Lipid extraction +
base-acid methylation



GC-FID + GC-MS

Proc MIXED SAS v9.4

Repeated measurement analysis

Model:

Fixed effects of **feed efficiency level** (H-FE vs. L-FE),

time (≈ challenge)

and their **interaction**

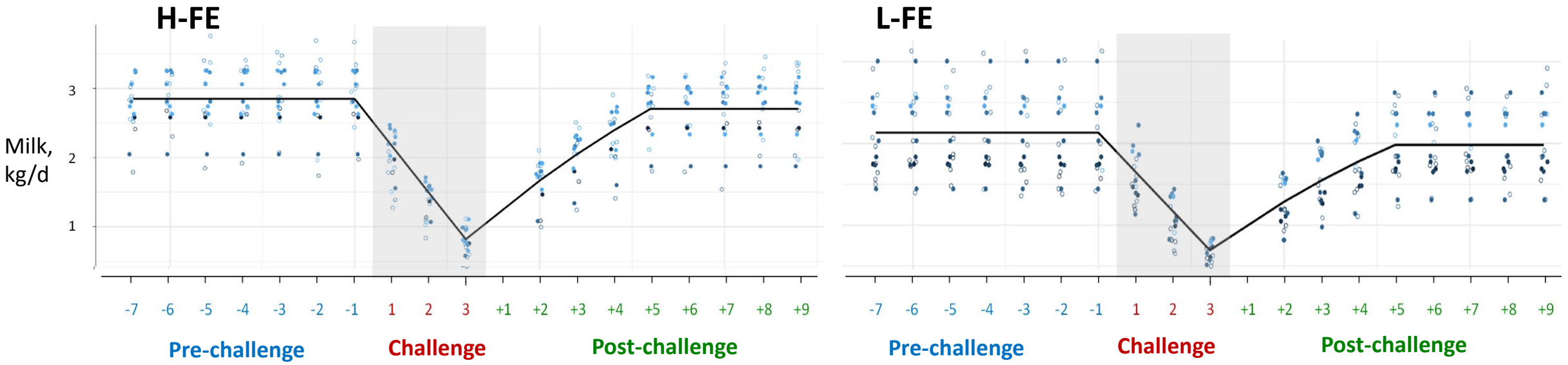
Means adjusted for multiple comparisons using **Bonferroni's** method

RESULTS - PERFORMANCE

Barrio et al. (2023) 10.3168/jds.2022-23174

Feed intake ⟹ No differences due to FE

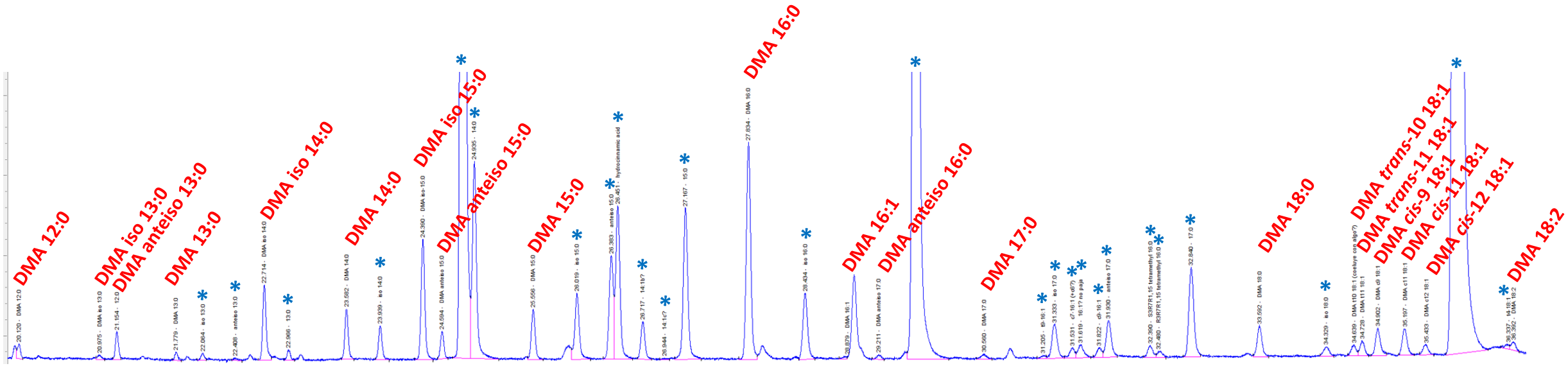
Milk yield ⟹ Greater in H-FE



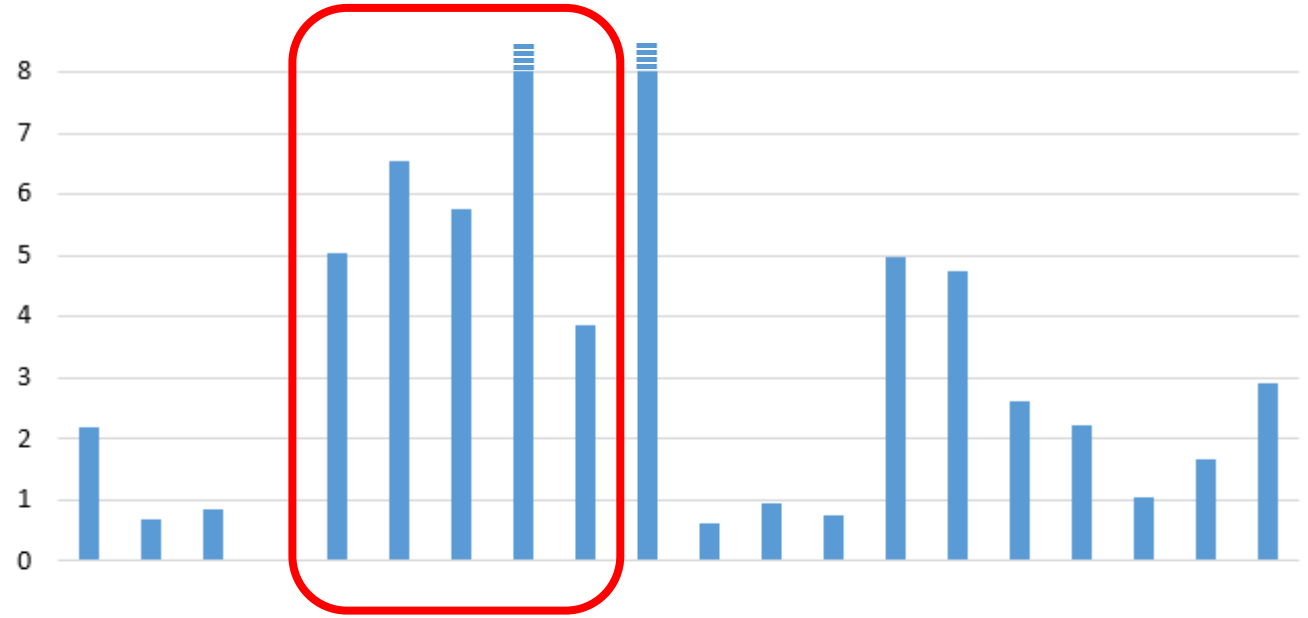
RESULTS - DIMETHYL ACETALS

22 DMA were identified (20 were quantified + 2 coeluted with fatty acids)

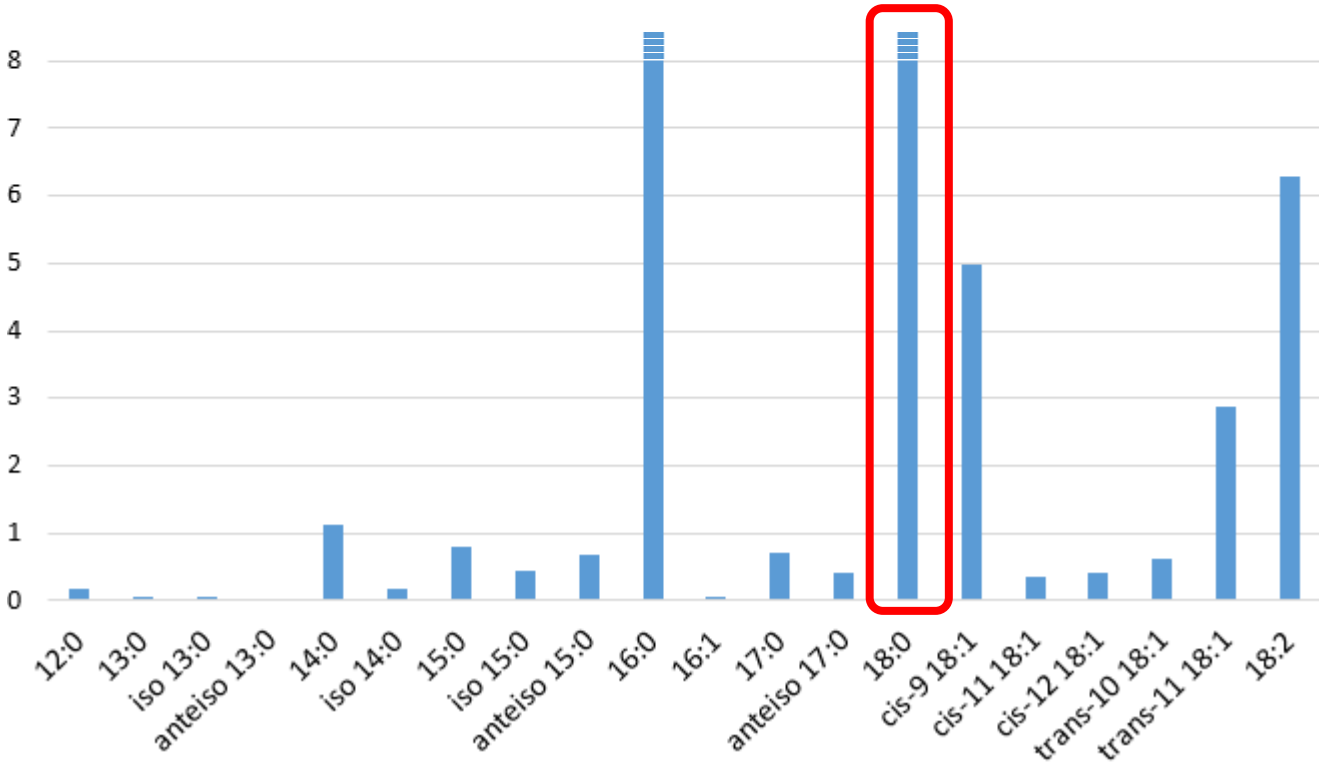
*** Fatty acid**



DMA, % total DMA
Pre-challenge



FA, % total FA
Pre-challenge



	P-value		
	Efficiency level	Time (challenge)	Efficiency x Time
DMA 12:0	0.389	<0.001	0.246
DMA 13:0	0.283	<0.001	0.679
DMA iso 13:0	0.200	<0.001	0.159
DMA anteiso 13:0	0.723	-	-
DMA 14:0	0.907	<0.001	0.860
DMA iso 14:0	0.165	<0.001	0.376
DMA 15:0	0.545	<0.001	0.294
DMA iso 15:0	0.774	<0.001	0.963
DMA anteiso 15:0	0.145	<0.001	0.184
DMA 16:0	0.987	<0.001	0.972
DMA 16:1	0.691	<0.001	0.991
DMA 17:0	0.892	<0.001	0.931
DMA anteiso 17:0	0.474	<0.001	0.488
DMA 18:0	0.726	<0.001	0.515
DMA *cis* -9 18:1	0.798	<0.001	0.411
DMA *cis* -11 18:1	0.596	<0.001	0.400
DMA *cis* -12 18:1	0.836	<0.001	0.288
DMA *trans* -10 18:1	0.766	<0.001	0.643
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Feed efficiency level

DMA ≠ biomarkers of efficiency

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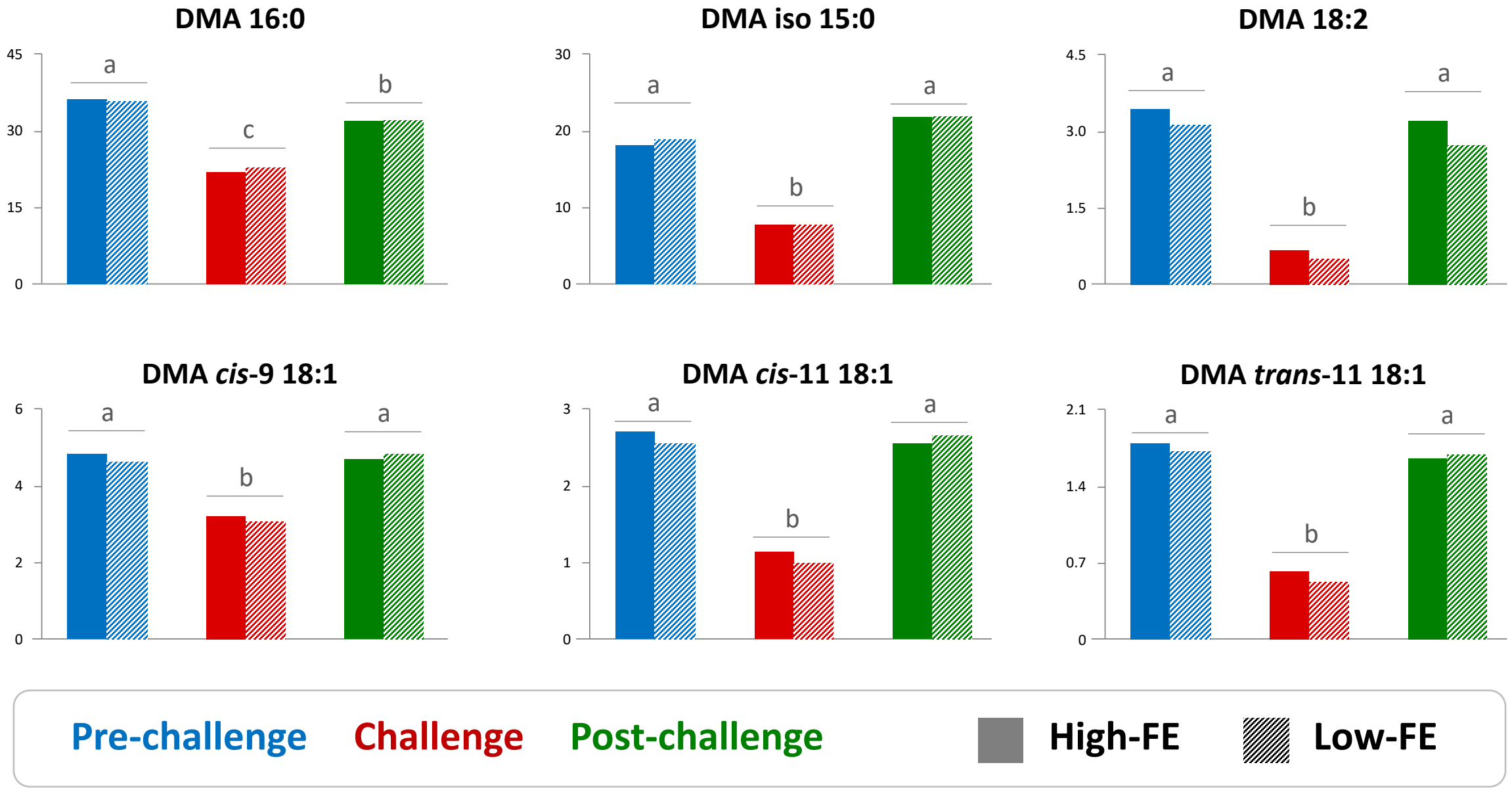
DMA ≠ biomarkers of efficiency

Strong effect of time

DMA = dynamic pattern of variation

DMA concentration, % of total DMA



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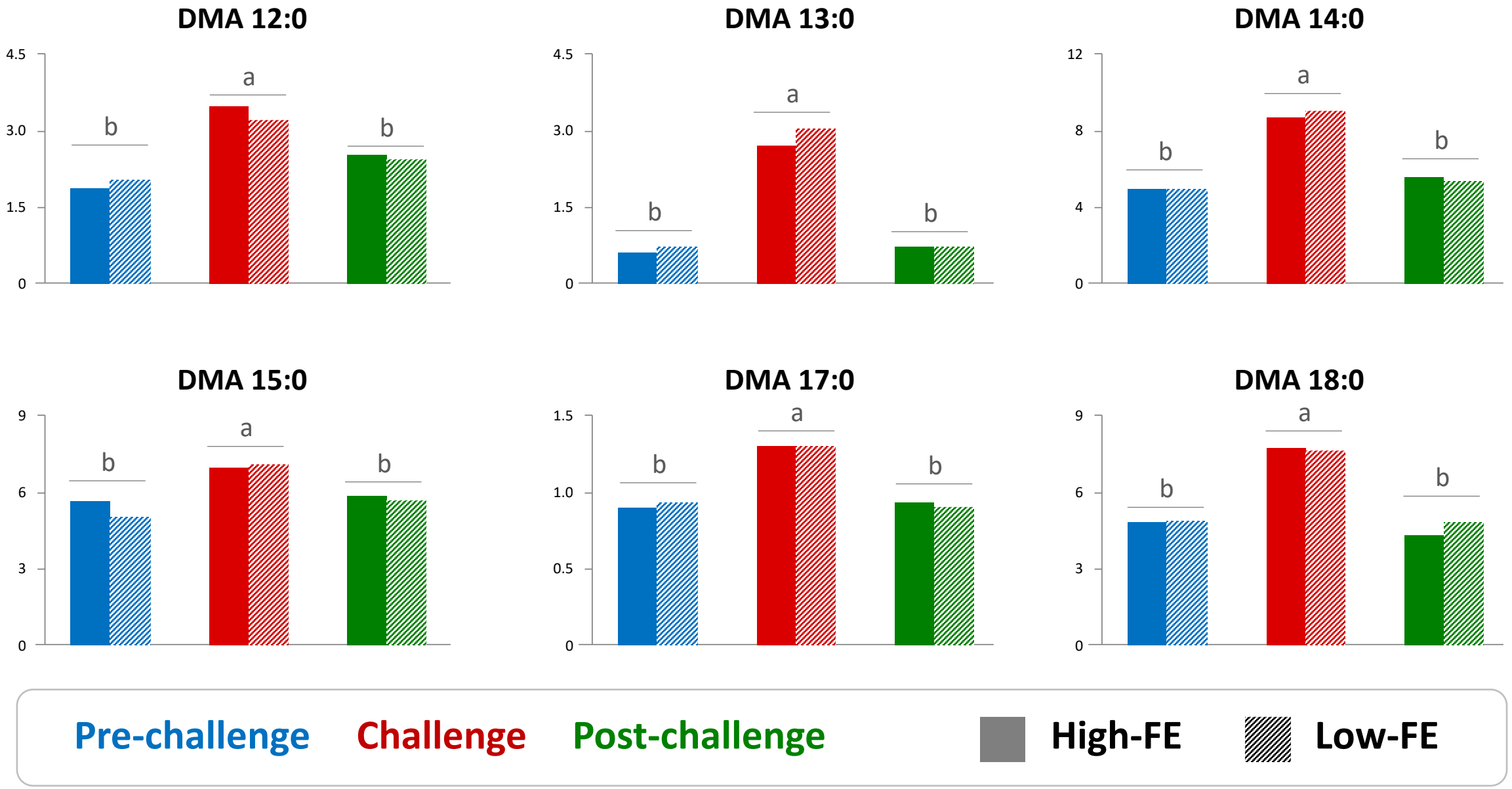

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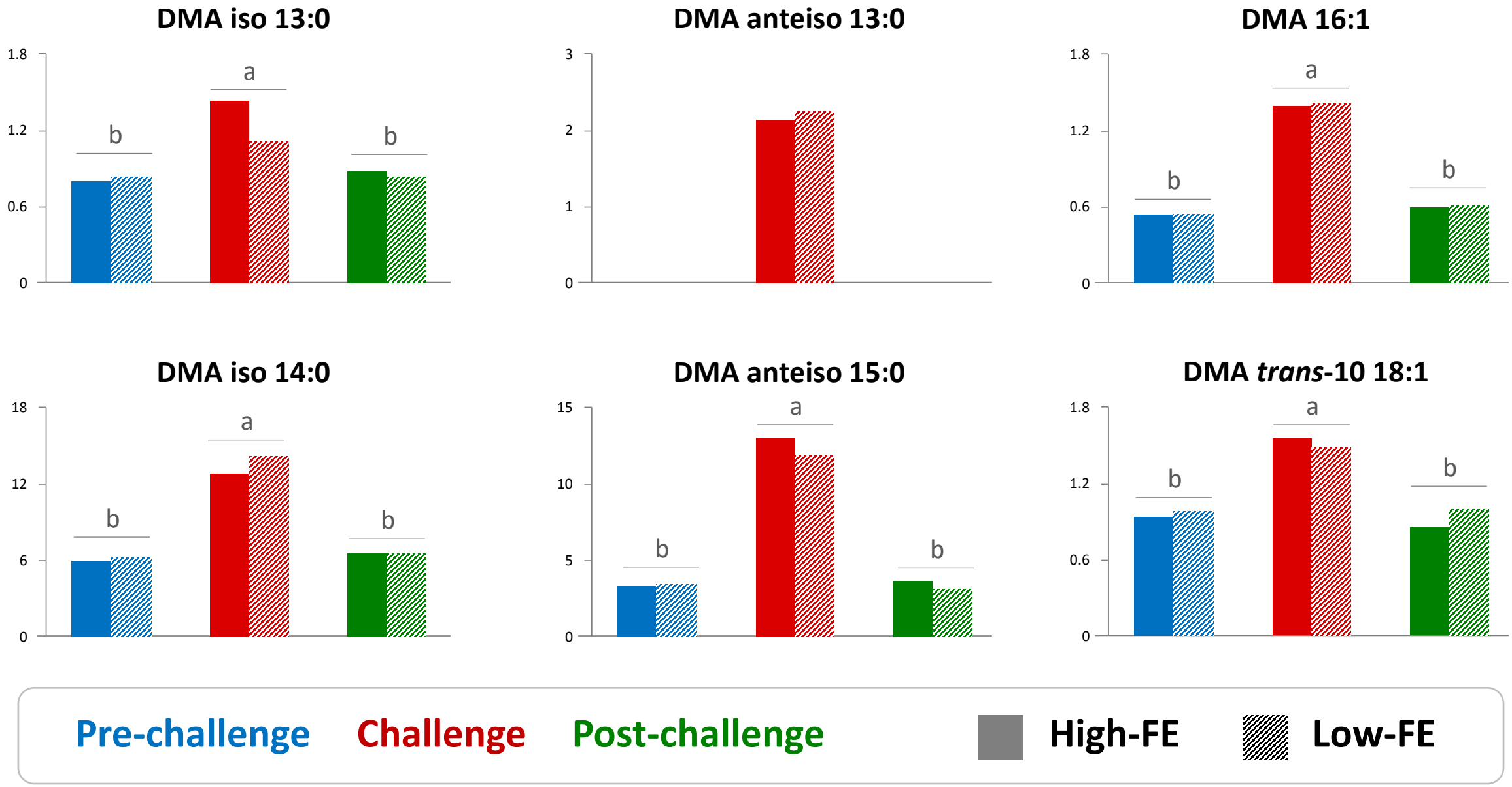

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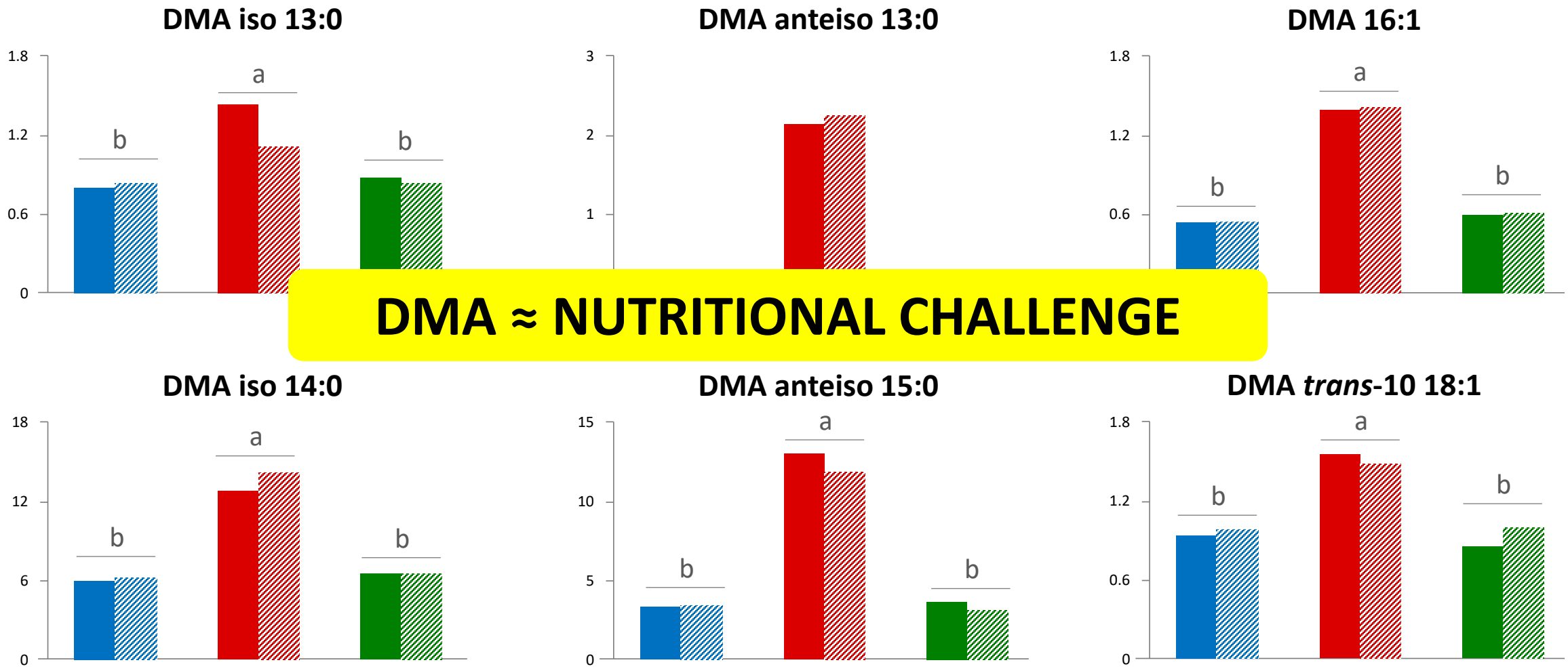

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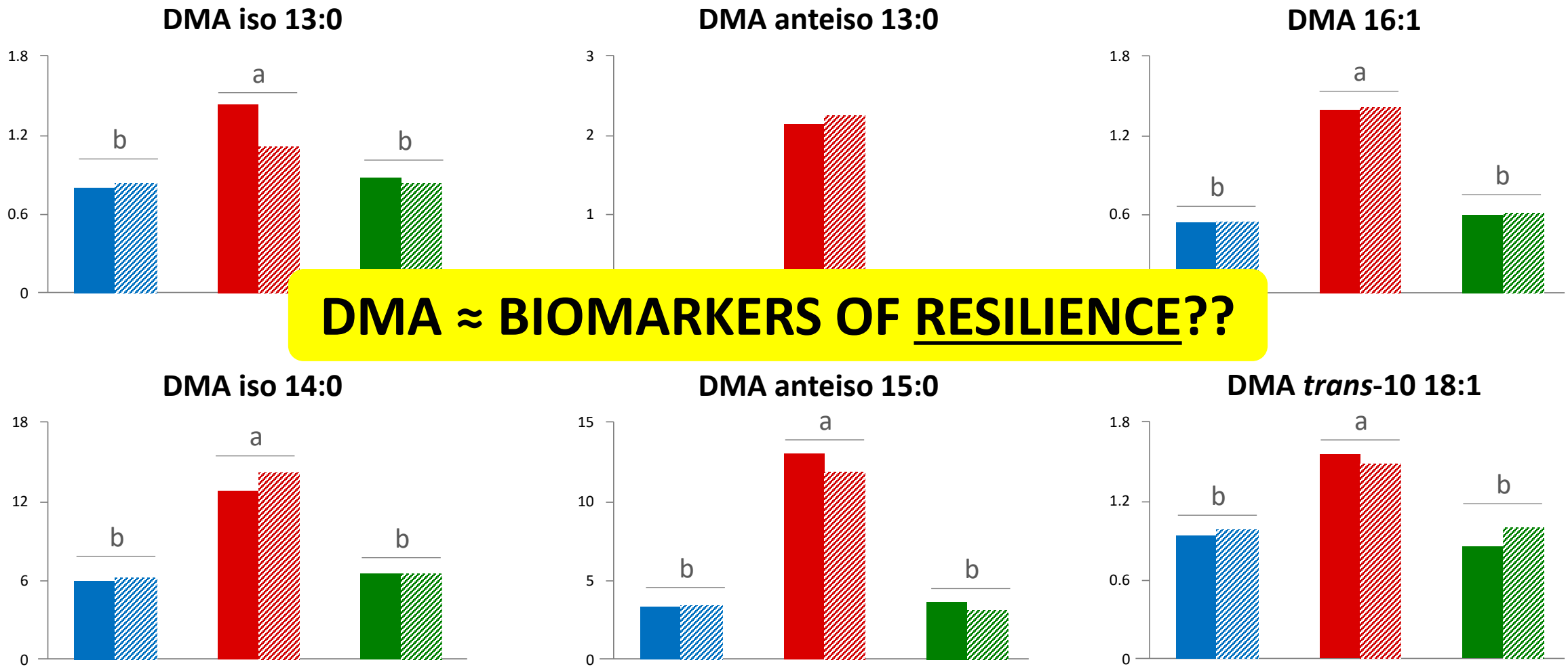
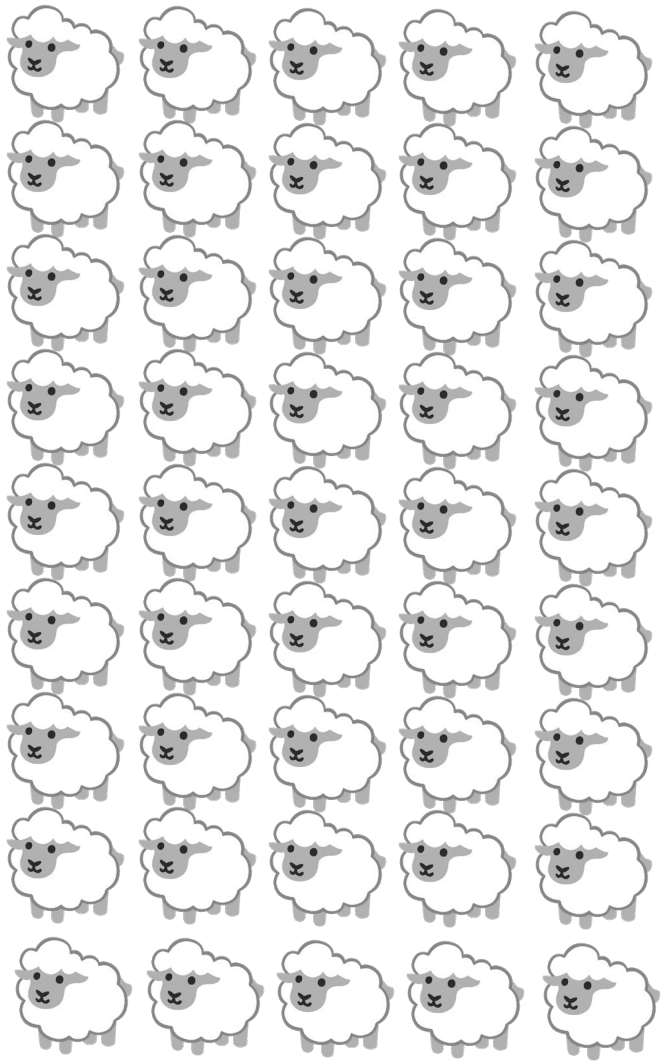


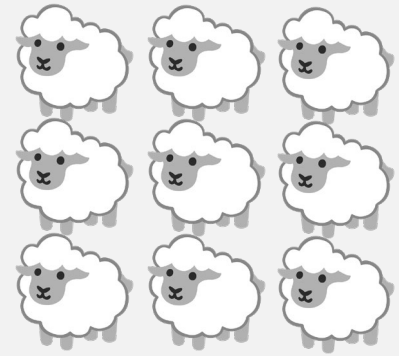
DMA ≈ BIOMARKERS OF RESILIENCE??

Pre-challenge Challenge Post-challenge High-FE Low-FE

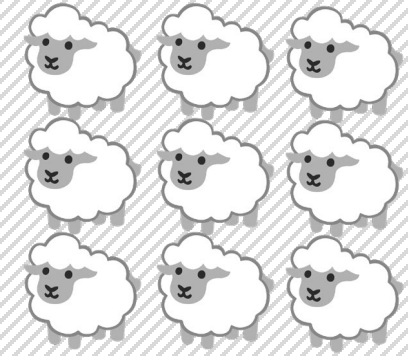


3 weeks

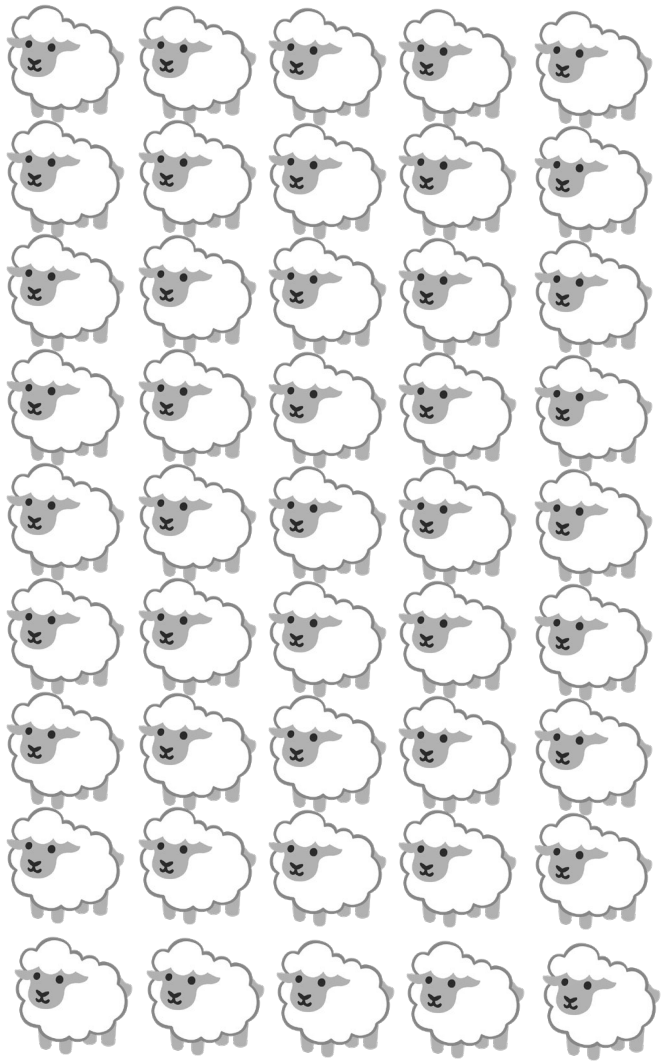
FEED EFFICIENCY estimation



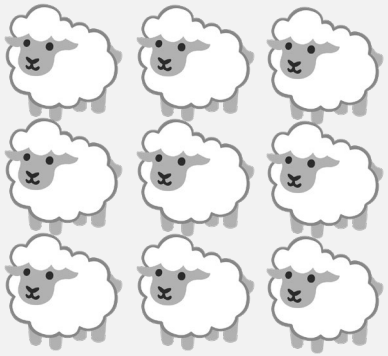
H-FE



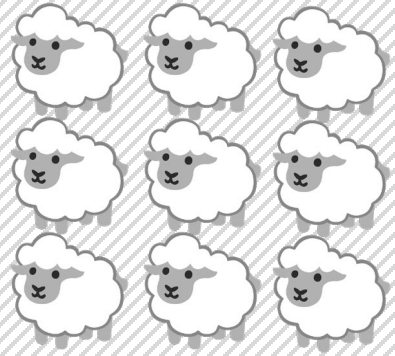
L-FE



CHALLENGE



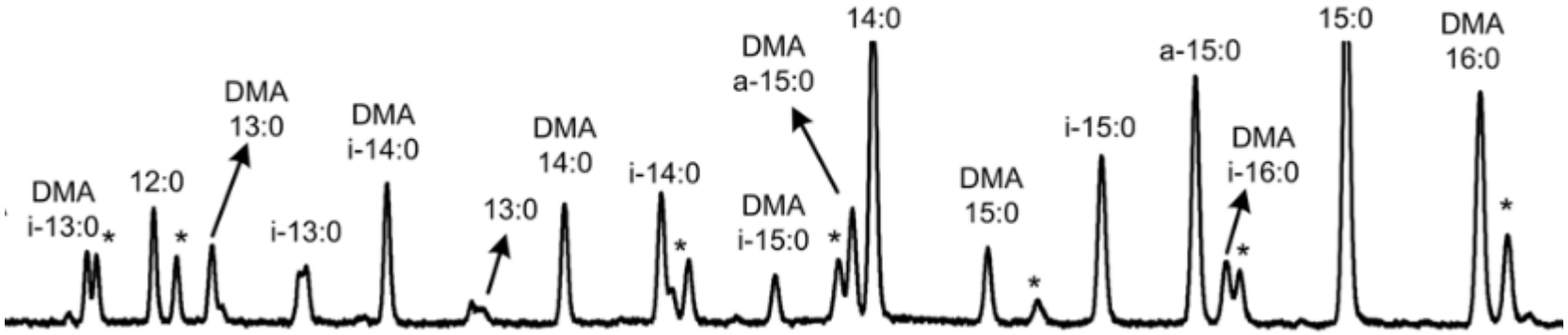
H-RESILIENCE



L-RESILIENCE

CONCLUSION

Rumen DMA composition was not related with feed efficiency, but their concentrations were very dynamic over time.
This finding and the characteristics of DMA basal levels would support a potential as biomarkers of ruminal microbiota.



SHORT-TERM vs. LONG-TERM UNDERFEEDING??

Session 96. Optimization of technical, economic, and environmental efficiency in sheep and goat production systems

Room: Calvana – Palazzo Congressi Ground floor

Chair: Cannas / Dadousis

Session Type: Theme session

16:30 **Is there any interaction between feed efficiency and resilience in dairy ewes subjected to underfeeding? 1) Feed intake and milk yield**

E. Barrio, P. Frutos, P. G. González-Merino, A. G. Mendoza, N. C. Friggens, P. G. Toral, G. Hervás

96.16 **Is there any interaction between feed efficiency and resilience in dairy ewes subjected to underfeeding? 2) Ruminal fermentation parameters**

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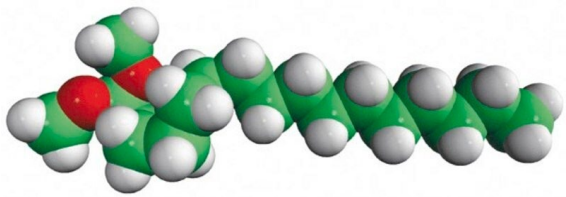

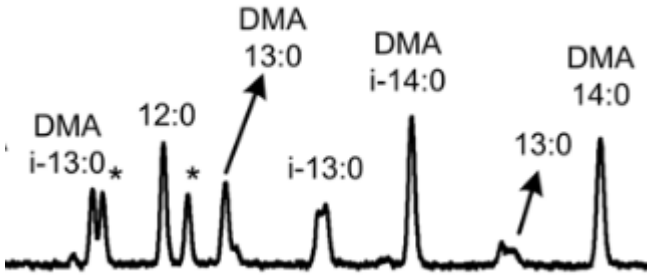

Thank you! **¡Gracias!** **Grazie!**