





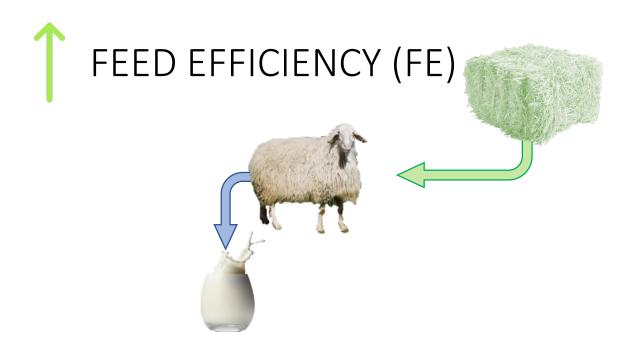
# Using milk fatty acids as biomarkers to improve feed efficiency in dairy sheep

<u>H. Marina</u>, G. Hervás, R. Pelayo, P.G. Toral, A. Suárez-Vega, B. Gutiérrez-Gil, C. Esteban Blanco, P. Frutos and J.J. Arranz









Molecular biomarkers

Useful for the genetic improvement of FE traits





Complex phenotype:

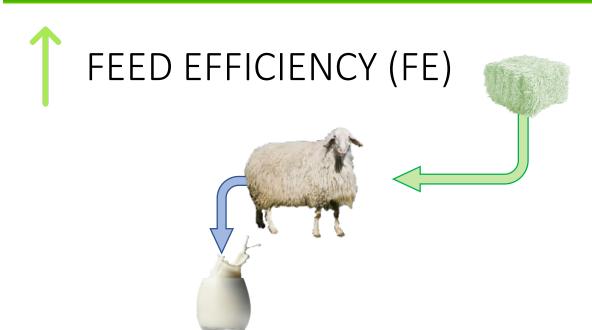
- Several traits (RFI, FCR, FEI) Difficult to measure:
- Specialized infrastructure



#### Introduction









Useful for the genetic improvement of FE traits



Feed efficient ewes:

Milk de novo fatty acids

Polyunsaturated fatty acids

(Toral et al. 2021)



To identify potential biomarkers for FE in milk and validate those proposed in the previous study



## Methods

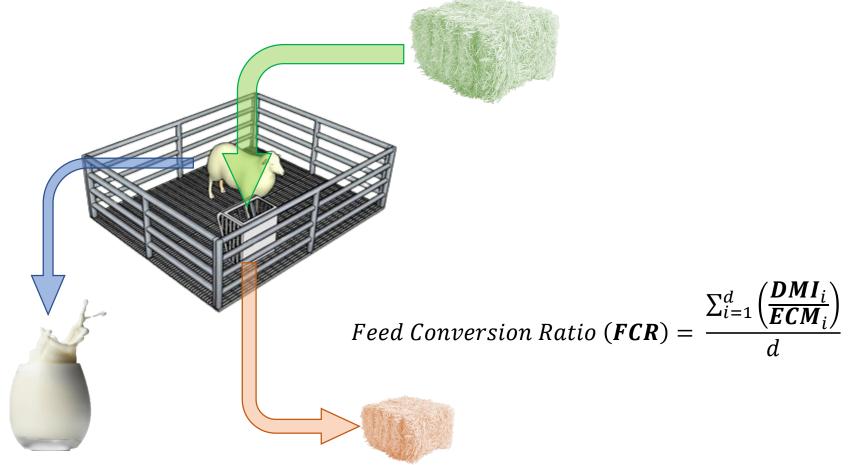




#### **Dry matter intake (DMI)**



39 Spanish Assaf ewes



**Energy-corrected milk (ECM)** 



## Methods











4 weeks

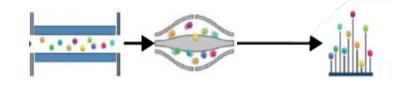






Energy-corrected milk (ECM)

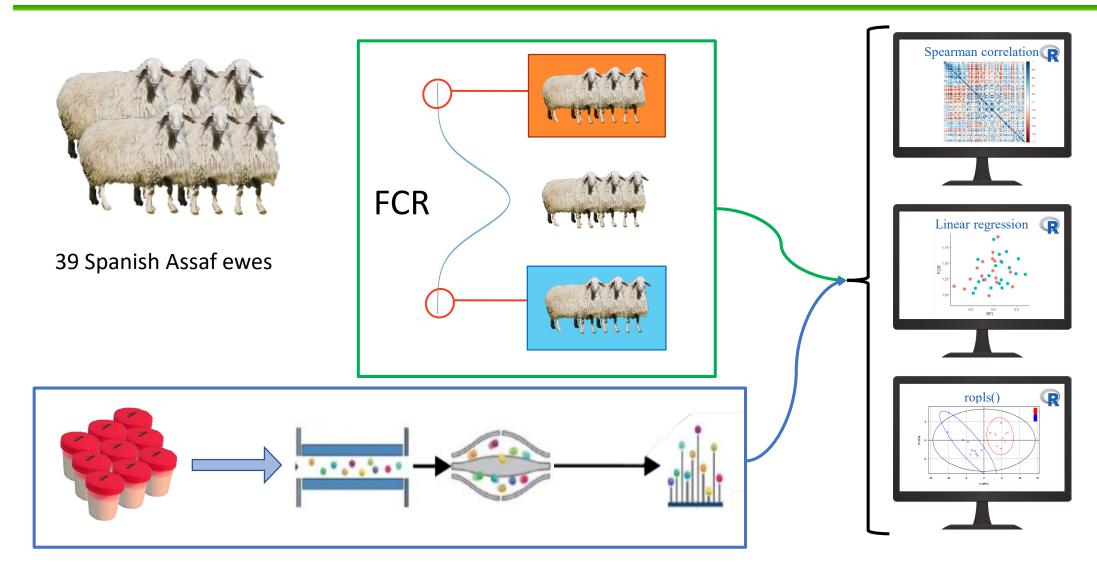
Fatty acid profile







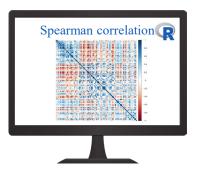






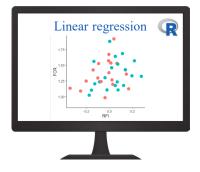






#### Spearman correlation:

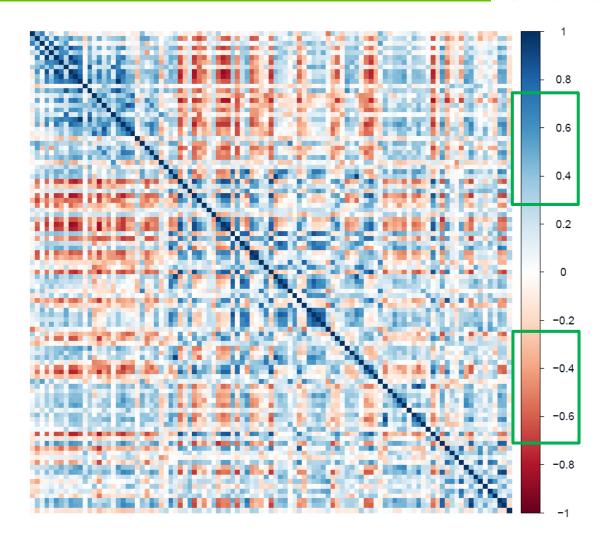
- 50 significant correlations
- Ranged from 0.32 to 0.70



#### Linear regression:

- 38 significant associations
- Adjusted R<sup>2</sup> values ranged from 0.08 to 0.31

36 common Milk Fatty Acids (MFAs) associated with the FCR parameter





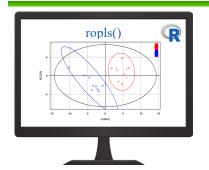


Milk Fatty Acids	Spearman Coef. <sup>1</sup> (P-value)	R <sup>2</sup> Adjusted <sup>2</sup> (P-value)	Milk Fatty Acids	Spearman Coef. <sup>1</sup> (P-value)	R <sup>2</sup> Adjusted <sup>2</sup> (P-value)
7:0	0.403 (0.011)	0.081 (0.044)	9:0	0.465 (0.003)	0.119 (0.018)
11:0	0.539 (0.001)	0.182 (0.004)	12:0	0.553 (0.001)	0.153 (0.008)
15:0	0.494 (0.001)	0.172 (0.005)	17:0	-0.585 (0.001)	0.194 (0.003)
22:0	0.687 (0.001)	0.277 (0.001)	24:0	0.704 (0.001)	0.294 (0.001)
16-oxo-18:0	-0.577 (0.001)	0.303 (0.001)	18:3n-3	0.458 (0.003)	0.15 (0.008)
18:3n-6	0.345 (0.032)	0.091 (0.035)	20:5n-3	0.393 (0.013)	0.127 (0.015)
cis-11 18:1	-0.434 (0.006)	0.101 (0.027)	cis-11 20:1	-0.492 (0.001)	0.155 (0.008)
cis-12 14:1	0.418 (0.008)	0.113 (0.021)	cis-12 18:1	0.521 (0.001)	0.203 (0.002)
cis-13 18:1	-0.428 (0.007)	0.117 (0.019)	cis-16 18:1	0.63 (0.001)	0.313 (0.001)
cis-7 14:1	0.376 (0.019)	0.084 (0.041)	cis-9 12:1	0.429 (0.006)	0.128 (0.015)
cis-9 17:1	-0.61 (0.001)	0.264 (0.001)	cis-9 18:1	-0.544 (0.001)	0.159 (0.007)
cis-9 trans-11 trans-15 CLnA	0.365 (0.022)	0.076 (0.049)	cis-9 trans-13 18:2	0.364 (0.023)	0.124 (0.016)
iso 15:0	0.399 (0.012)	0.105 (0.025)	iso 17:0	0.505 (0.001)	0.267 (0.001)
iso 18:0	-0.384 (0.016)	0.104 (0.025)	trans-10 18:1	-0.595 (0.001)	0.261 (0.001)
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trans-15 18:1	0.466 (0.003)	0.258 (0.001)	trans-4 18:1	-0.435 (0.006)	0.183 (0.004)
trans-9 cis-11 CLA	-0.478 (0.002)	0.143 (0.010)	trans-9 trans-12 cis-15 + cis-9 cis-12 trans-15 18:3	0.527 (0.001)	0.157 (0.007)



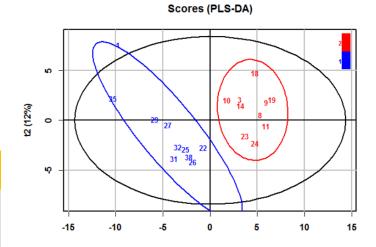


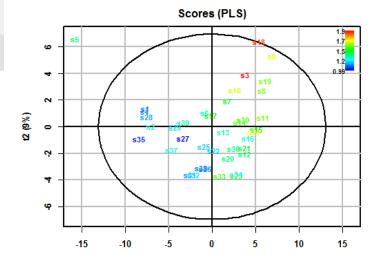






oPLS					
FCR	Number of animals	Number of MFA	Explained variation in X	Explained variation in Y	Predictive Performance
Groups	10+10	101	0.41	0.91	0.82
Values	39	101	0.48	0.82	0.46











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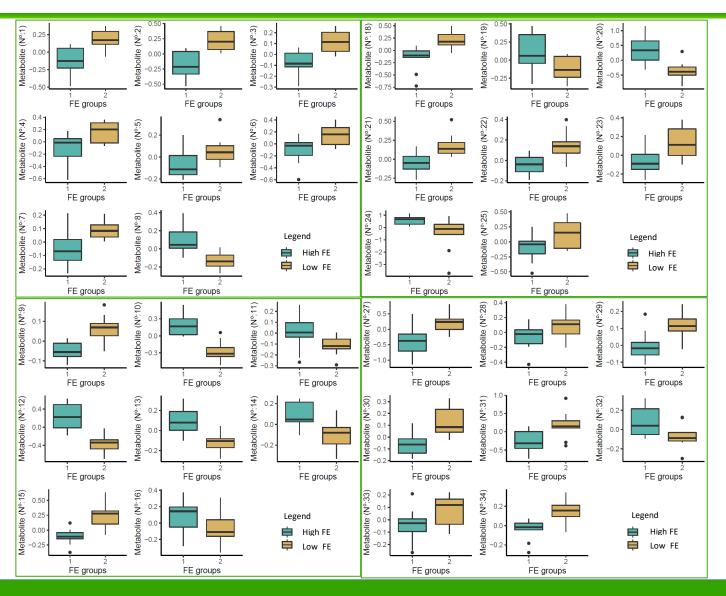
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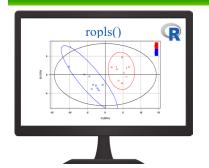














Validation

		Scores	(PLS-DA)	
12 (12%) -5 0 5	15 -10	29 27 3225 22 31 38 <sub>26</sub>	18 10 34 919 8 11 23 24	10 15

ECB	Number of	Nu
1 (1)		

animals	
10+10	
39	

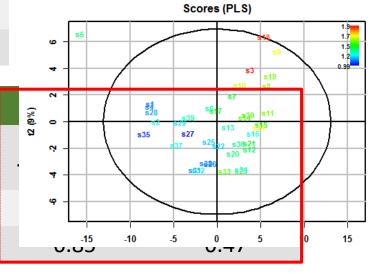
Number of MFA
101
101

Explained variation in X	Explained variation in Y	Predictive Performance
0.41	0.91	0.82
0.48	0.82	0.46



Closs validated of Ls				,	
FCR	Number of animals	Number of MFA	Explained variation in X	Explained variation in Y	Predictive Performance
Groups	10	33	0.72	0.94	0.83
Values	20	33	0.66	0.65	0.10

oPLS



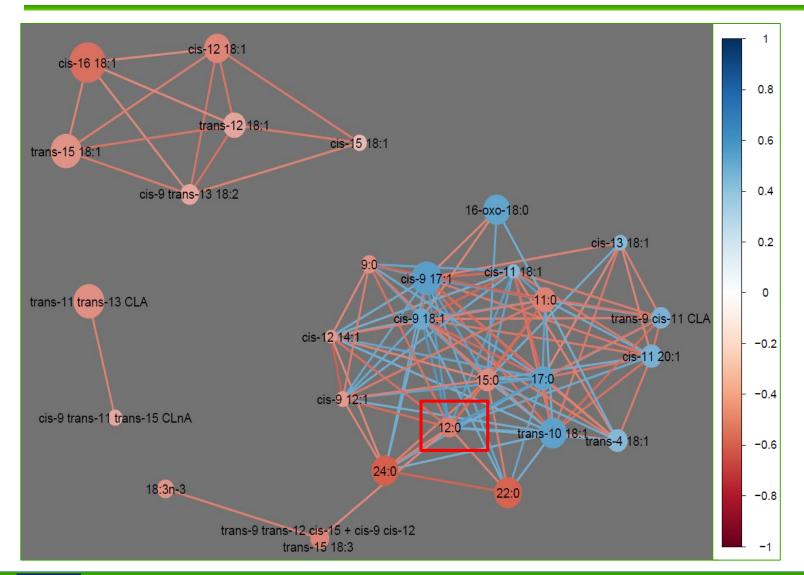


Groups

Values







Particularly, the FCR index showed a significant correlation with the lauric acid (C12:0), fatty acid highly studied in relation to human health

Ten long-chain MFAs out of the 33 MFAs highlighted in this study showed **negative** correlations with FCR, suggesting that selecting for higher FE would modify their concentration in the milk





# Conclusions and Perspectives



- The MFA profile has proven to be useful for predicting FCR
- This study has validated in an independent population the results obtained by Toral *et al.* 2021
- Further studies should:
  - Analyse the 33 MFAs highlighted in this work in a larger population
  - Consider different approaches (i.e. ML) to assess their accuracy and usefulness
  - Study the **pros and cons of implementing FE as a breeding target** on the technological and organoleptic characteristics of dairy sheep products





## Acknowledgments

























































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# Acknowledgments





