

Combining clinical mastitis with somatic cell indicators for udder health selection in Spanish dairy cattle

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Introduction

- Mastitis: economic losses and animal welfare
- CM is not routinely recorded and available
- Indirect selection: Lactation SCS (LSCS)
- Spain:
 - Genetic evaluation LSCS since 2003
 - I-SA project (2012)
- Is CM different in primiparous cows?
- Is CM different at different stages of lactation?
- Which is the best indicator of CM?

Objectives

- To estimate genetic parameters of CM and alternative traits based on SCC:
 - Average SCS
 - Peak SCC
- To define the best CM indicator based on data from milk recording system

Material and Methods

- Data from Galicia (NW Spain)
- I-SA project (CONAFE)
 - CM (0/1): Secretion of visually abnormal milk or udder tissue inflammation.
- Milk recording system
 - ASCS: Average of log-transformation of SCC
 - SCC_x (0/1): Any test-day >x cells/ml (x=100, 200, 400 x10³)

Records n.	56,435
Cows n.	31,274
Sires n.	2,458
Herds n.	393
Lactations	1 to 5
Years	2013-2017

Lactation number	Stage of lactation (period)		
	-15 to 60 DIM	61 to 150 DIM	151 to 305 DIM
1 (1L)	P1	P2	P3
2-5 (2+L)	P1		P2

Material and Methods

- 7 CM traits:
 - **CM_1L**: First lact.
 - **CM_2+L**: Second to fifth lact.
 - **CM_1LP1**: -15 to 60 DIM
 - **CM_1LP2**: 61 to 150 DIM
 - **CM_1LP3**: 151 to 305 DIM
 - **CM_2+LP1**: -15 to 150 DIM
 - **CM_2+LP2**: 151 to 305 DIM
- 29 SCS/SCC traits:
 - **ASCS**: Average SCS
 - **SCC100**: Peak >100,000 cells/ml
 - **SCC200**: Peak >200,000 cells/ml
 - **SCC400**: Peak >400,000 cells/ml

Material and Methods

Trait	N. rec.	Min	Max	Mean	s.d.	
CM_1L	17,877	0	1	0.112	0.316	11.2% CM
ASCC_1L (x 1,000)	14,835	96	937	322.865	128.182	
SCC100_1L	14,835	0	1	0.854	0.353	
SCC200_1L	14,835	0	1	0.657	0.475	
SCC400_1L	14,835	0	1	0.450	0.498	

Trait	N. rec.	Min	Max	Mean	s.d.	
CM_2+L	36,599	0	1	0.191	0.393	19.1% CM
ASCC_2+L (x 1,000)	27,334	11	952	305.933	156.128	
SCC100_2+L	27,334	0	1	0.803	0.398	
SCC200_2+L	27,334	0	1	0.638	0.481	
SCC400_2+L	27,334	0	1	0.478	0.499	

Material and Methods

- VCE 6.0
- Linear animal model

$$\mathbf{1L:} \quad y_{ijklm} = hy_i + mo_j + LAE_k + id_l + \varepsilon_{ijklm}$$

$$\mathbf{2+L:} \quad y_{ijklmn} = hy_i + mo_j + LAE_k + id_l + pe_m + \varepsilon_{ijklmn}$$

$$\begin{pmatrix} \mathbf{id} \\ \mathbf{pe} \\ \boldsymbol{\varepsilon} \end{pmatrix} \sim N \left(0, \begin{pmatrix} \mathbf{A}\sigma_{id}^2 & \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{I}\sigma_{pe}^2 & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{I}\sigma_{\varepsilon}^2 \end{pmatrix} \right)$$

hy: herd-year of calving (934 levels)

mo: month of calving (12 levels)

LAE: lactation-age (57 levels)

id: additive genetic effect (66,713 levels)

pe: permanent environmental effect (22,414 levels)

ε : residuals

Results and discussion

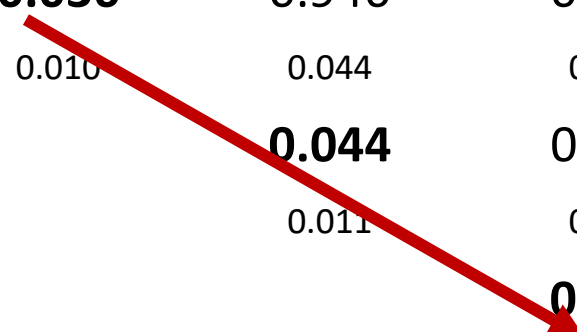
- Genetic correlations **between lactations** (1L vs 2+L)

	CM_1L	ASCS_1L	SCC100_1L	SCC200_1L	SCC400_1L
CM_2+L	0.999	0.950	0.922	0.928	0.976
ASCS_2+L	0.879	0.989	0.988	0.959	0.947
SCC100_2+L	0.654	0.965	0.999	0.974	0.864
SCC200_2+L	0.895	0.999	0.999	0.999	0.990
SCC400_2+L	0.971	0.983	0.992	0.999	0.999

Results and discussion

- Genetic parameters **within lactation (1L)**

	CM_1L	ASCS_1L	SCC100_1L	SCC200_1L	SCC400_1L
CM_1L	0.020 0.006	0.852 0.094	0.907 0.180	0.976 0.086	0.993 0.064
ASCS_1L		0.112 0.018	0.918 0.075	0.999 0.001	0.935 0.033
SCC100_1L			0.036 0.010	0.946 0.044	0.740 0.118
SCC200_1L				0.044 0.011	0.918 0.049
SCC400_1L					0.059 0.013



Results and discussion

- Genetic parameters **within lactation (1L) by period**

	CM_1LP1	CM_1LP2	CM_1LP3
CM_1L	0.887	0.981	0.873
CM_1LP1	0.012	0.806	0.556
CM_1LP2		0.010	0.906
CM_1LP3			0.007

		ASCS	SCC100	SCC200	SCC400	
CM	P1	0.613	0.770	0.723	0.734	↓ >150 DIM
	P2	0.622	0.630	0.769	0.837	
	P3	0.867	0.782	1.000	1.000	
ASCS	P1	-	0.911	0.984	0.945	
	P2	-	0.973	0.970	0.902	
	P3	-	1.000	0.989	0.900	

Results and discussion

- Genetic parameters **within lactation (2+L)**

	CM_2+L	ASCS_2+L	SCC100_2+L	SCC200_2+L	SCC400_2+L
CM_2+L	0.023 0.006	0.945 0.043	0.780 0.094	0.850 0.061	0.875 0.087
ASCS_2+L		0.143 0.015	0.903 0.033	0.958 0.020	0.937 0.021
SCC100_2+L			0.050 0.009	0.956 0.021	0.812 0.057
SCC200_2+L				0.062 0.011	0.947 0.023
SCC400_2+L					0.076 0.012

Results and discussion

- Genetic parameters **within lactation (2+L) by period**

	CM_2+LP1	CM_2+LP2
CM_2+L	0.999	0.985
CM_2+LP1	0.010	0.977
CM_2+LP2		0.011

		ASCS	SCC100	SCC200	SCC400
CM	P1	0.948	0.847	0.873	0.851
	P2	0.743	0.435	0.807	1.000
ASCS	P1	-	0.956	0.992	0.960
	P2	-	0.962	0.966	0.898

<150 DIM

Conclusions

- For CM:
 - Distinction between 1L and 2+L is not necessary
 - Different periods within lactation are worthy
- ASCS + SCC200 could be considered with CM in multi-trait evaluation for udder health improvement

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Thank you!

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