Index for Mastitis Resistance and Use of BHBA for Evaluation of Health Traits in Canadian Holsteins

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Genetic evaluation for mastitis resistance

❖ **In August 2014, first official run of genetic evaluations for mastitis resistance**

❖ **Multiple-trait linear animal model (Jamrozik et al., 2013)**

  ➤ First vs. later parities: clinical mastitis, mean SCS, standard deviation of SCS, excessive test-day SCC

  ➤ First parity cows: udder depth, fore udder attachment, body condition score

❖ **Genetic evaluations expressed as relative breeding values (RBV) with a mean of 100 and a SD of 5 (higher values are desirable)**

Objective

❖ **Development of a Mastitis Resistance Index**

➤ **Clinical mastitis in first lactation (CM-F)**

➤ **Clinical mastitis in later lactations (CM-L)**

➤ **SCS from Canadian Test Day Model**

Why an index?

❖ **Why not using just mastitis EBV?**

❖ **Mastitis EBV are indicators of clinical mastitis**

❖ **SCS EBV are indicators of subclinical mastitis**
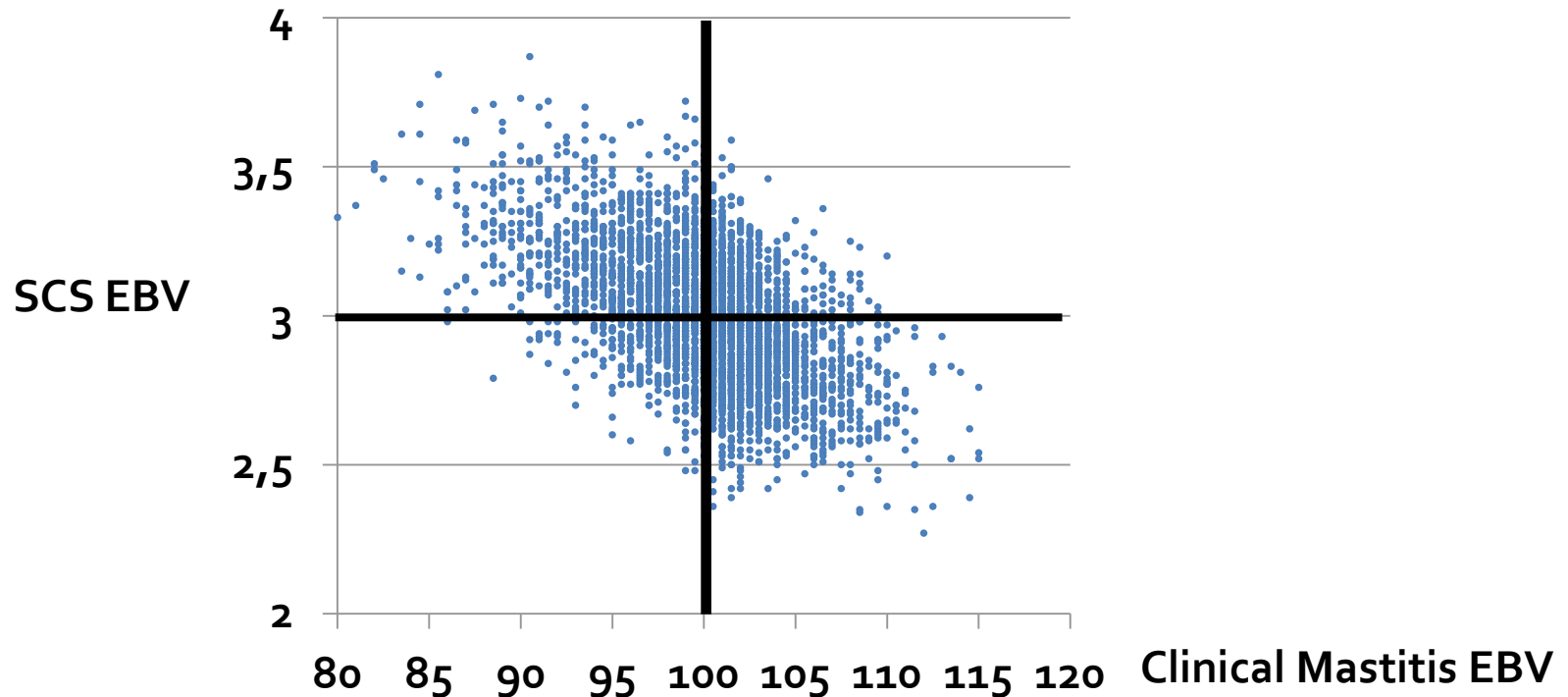
Boettcher et al., 1998

❖ **Udder health index**

➤ Subclinical mastitis (measured by SCS) in lactations 1 and ≥2

➤ Clinical mastitis in lactations 1 and ≥2

➤ Milking time

➤ Estimated economic weights were -$12, -$31, -$15, -$59 and -$11, respectively, per genetic standard deviation.

➤ At that time clinical mastitis was not recorded, thus traits in the selection index were milking speed, udder conformation and SCS in first and later lactations

Mastitis Resistance Index

❖ **Based on the work by Boettcher et al. (1998)**

Mastitis Resistance (MR) = 1/3 CM-F + 1/3 CM-L - 1/3 SCS

where;

CM-F = Clinical Mastitis in First lactation

CM-L = Clinical Mastitis in Later lactations

SCS = overall SCS evaluation as officially published whereby low values are desired

Selection response

❖ **Assumptions**

➢ **Heritability for CM-F, CM-L and SCS = 0.03, 0.05, 0.20, respectively**

➢ **Genetic correlations among the three traits: CM-F with CM-L = 0.60 and 0.55 for the other 2 combinations**

➢ **Reliability of RBV for MR traits = 0.30, and for SCS = 0.50 (conservative estimates)**

➢ **Selection only on Mastitis Resistance (with various combinations/emphasis among 3 traits)**

Selection response

Weights			Genetic gain per year (RBV points)		
CM-F	CM-L	SCS	CM-F	CM-L	SCS
1/3	1/3	1/3	0.14	0.19	0.44
0.5	0.5	0	0.13	0.18	0.24
0	0	1	0.13	0.17	0.63
1	0	0	0.15	0.12	0.21
0	1	0	0.11	0.23	0.25
1/6	3/6	2/6	0.13	0.20	0.44
0.5	0	0.5	0.15	0.16	0.50

Genetic trends
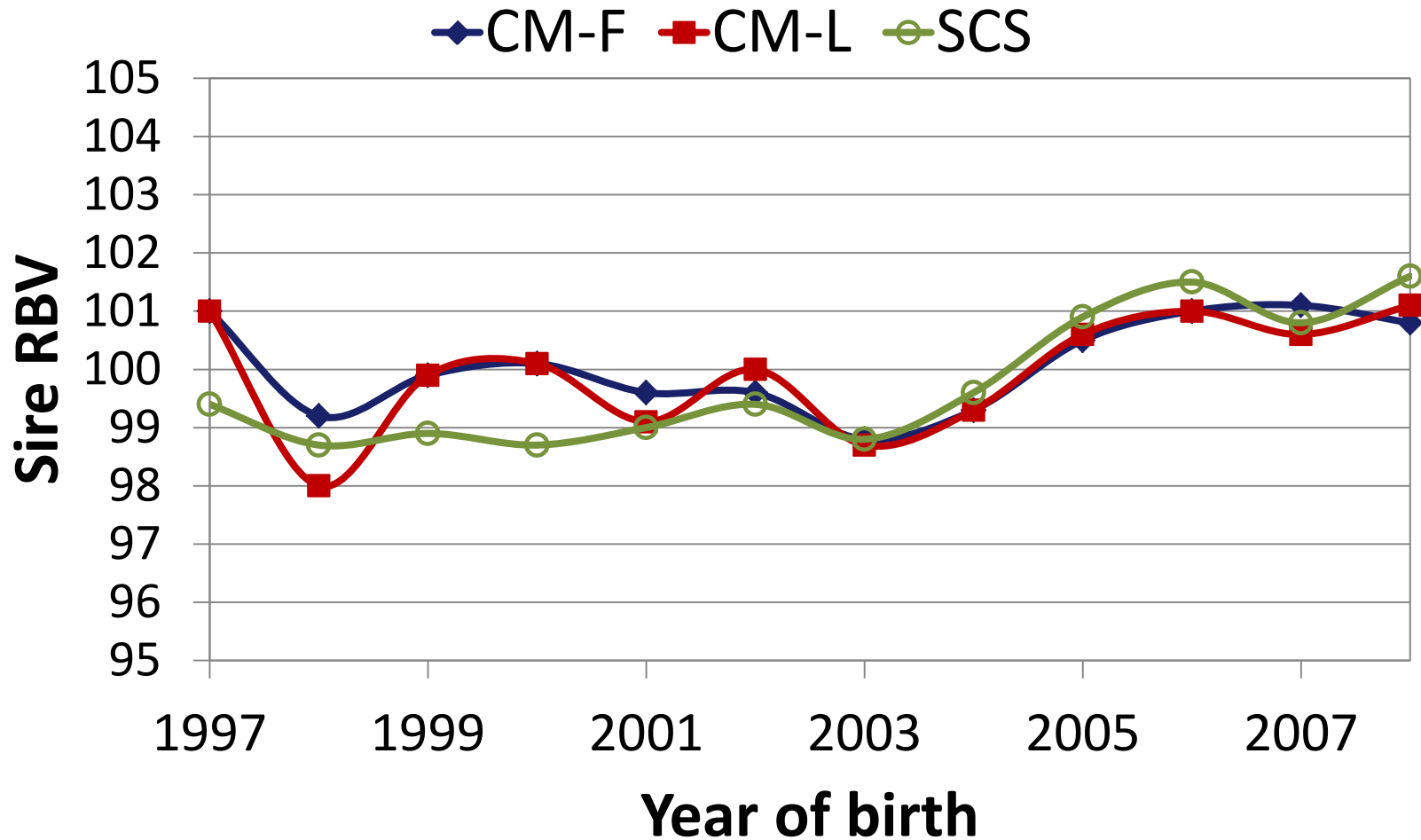
Conclusions

❖ **New index for Mastitis Resistance**

❖ **Equal weights for CM-F, CM-L and SCS**

➢ **2/3 on clinical mastitis and 1/3 on SCS**

➢ **Equal weight between clinical mastitis in first vs. later**

❖ **Expressed on RBV scale, mean of 100, SD of 5**

➢ **Higher value is desirable**

➢ **At least 45 REL with 10 daughters in 10 herds**

❖ **Higher accuracy of selection for both clinical and subclinical mastitis**

# Use of BHBA for Evaluation of Health Traits in Canadian Holsteins

Milk ß–hydroxybutyrate (BHBA)

❖ **Hyperketonemia or ketosis is one of the most frequent diseases in dairy cattle**

❖ **Level of milk ß-hydroxybutyrate (BHBA) is an indicator of subclinical ketosis**

❖ **Since October 2011 screening for hyperketonemia based on a BHBA analysis by MIR of test-day milk samples is offered in Canada by Valacta**
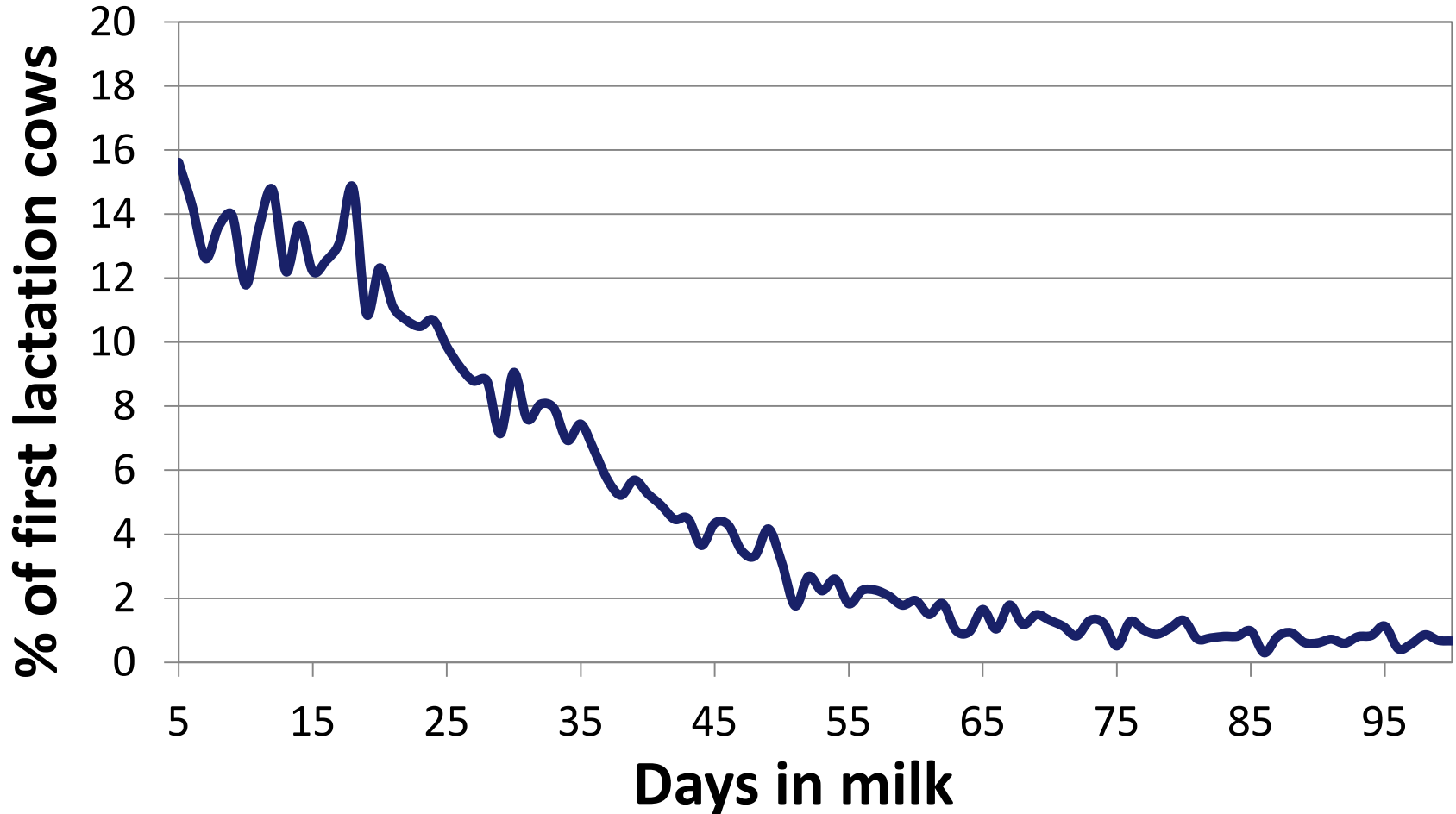
Objective

❖ **Estimate genetic parameters for milk BHBA in first lactation Holstein cows**

❖ **Determine genetic correlations between milk BHBA and metabolic diseases (clinical ketosis and displaced abomasum)**

Mean milk BHBA
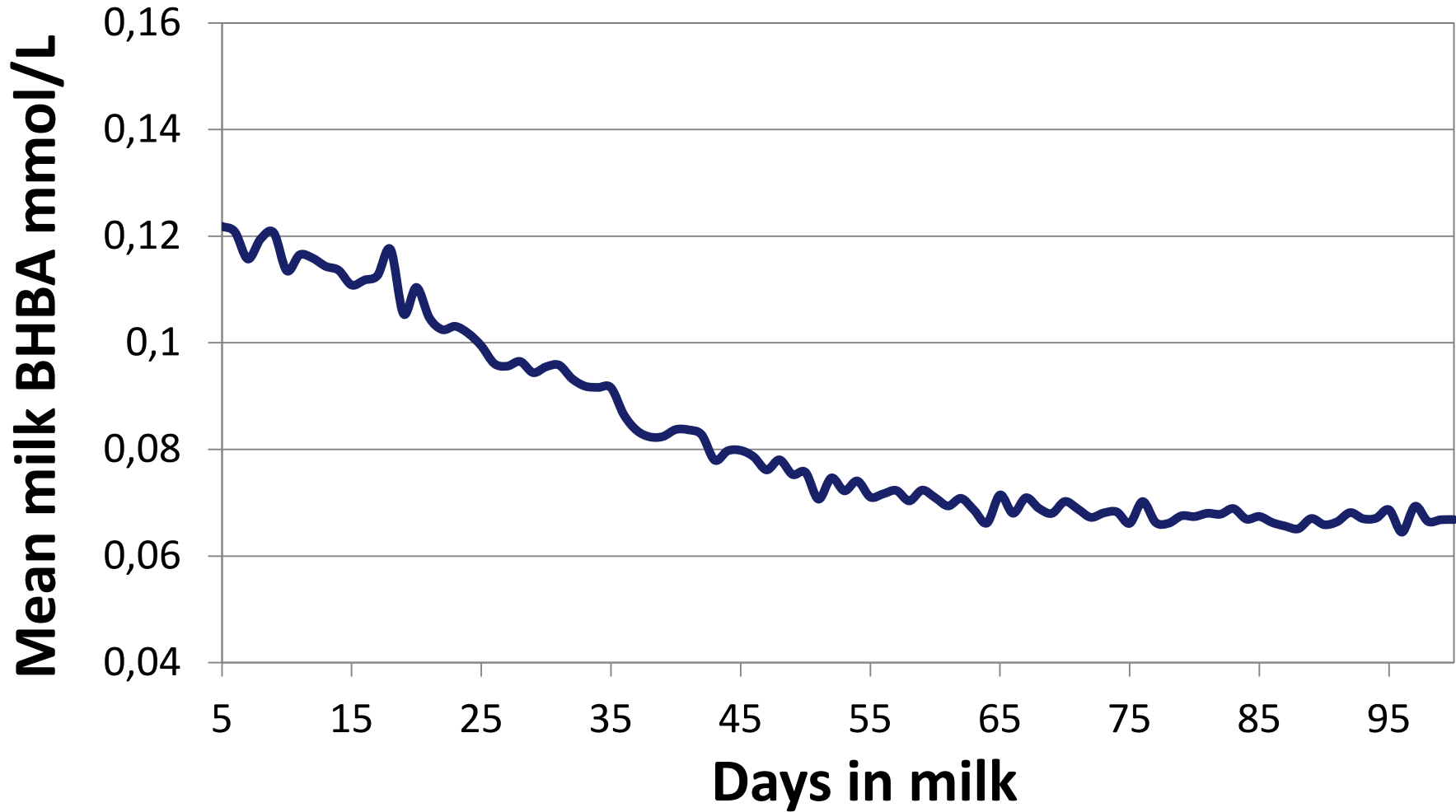
Proportion (%) of cows with a positive (milk BHBA ≥ 0.20 mmol/L) test result

Analysis of milk BHBA

Trait	DIM	Records, no.	Mean
$BHBA_1$, mmol/L	5-20	20,845	0.115
$BHBA_2$, mmol/L	21-40	26,871	0.094
$BHBA_3$, mmol/L	41-60	27,404	0.075
$BHBA_4$, mmol/L	61-80	27,233	0.068
$BHBA_5$, mmol/L	81-100	26,811	0.067

Heritabilities and genetic correlations

Trait	$BHBA_1$	$BHBA_2$	$BHBA_3$	$BHBA_4$	$BHBA_5$
$BHBA_1$	**0.13**	0.96	0.84	0.75	0.67
$BHBA_2$		**0.13**	0.99	0.85	0.77
$BHBA_3$			**0.16**	0.98	0.96
$BHBA_4$				**0.22**	0.99
$BHBA_5$					**0.29**

Associations between milk BHBA and metabolic diseases

❖ **Milk BHBA at the first test-day (5-40 DIM)**

❖ **Ketosis**

❖ **Displaced abomasum**

Trait	Records, no.	Mean
BHBA, mmol/L	7,635	0.10
KET frequency, %	3,437	3.61
DA frequency, %	6,894	2.74

Frequency of clinical ketosis and displaced of negative, suspect and positive tested cows
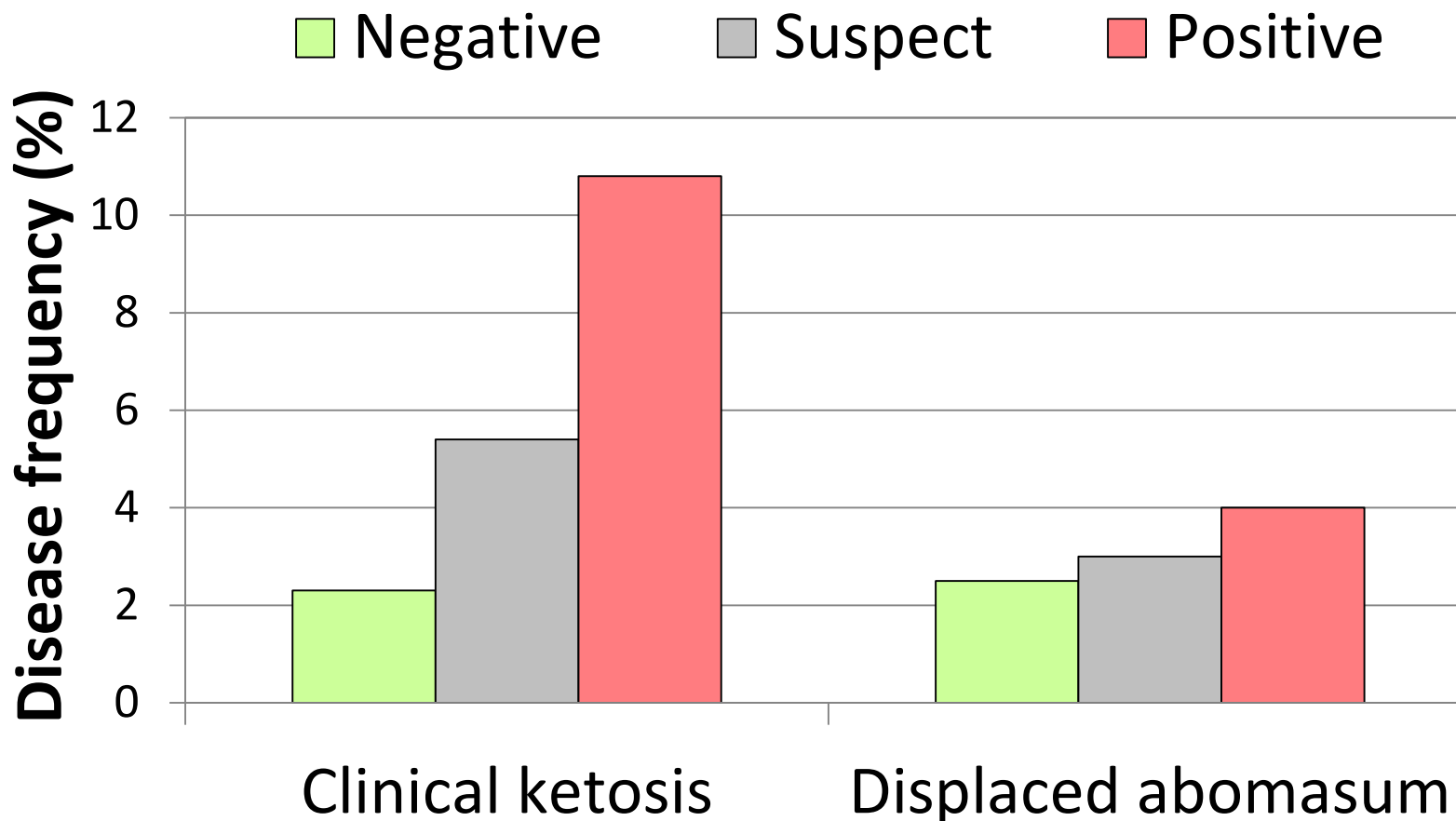
Heritabilities and genetic correlations

Trait	BHBA	KET	DA
BHBA	**0.13 (0.01)**	0.50 (0.26)	0.21 (0.16)
KET		**0.03 (0.03)**	0.63 (0.43)
DA			**0.05 (0.02)**

Conclusions

❖ **Heritabilities for milk BHBA ranging from 0.13 to 0.29**

❖ **Higher milk BHBA in early lactation was genetically associated with a higher frequency of clinical ketosis and displaced abomasum**

❖ **Milk BHBA can be routinely analyzed in milk samples on test-days, and, therefore, provide a practical tool for breeding cows with a lower susceptibility to hyperketonemia**

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