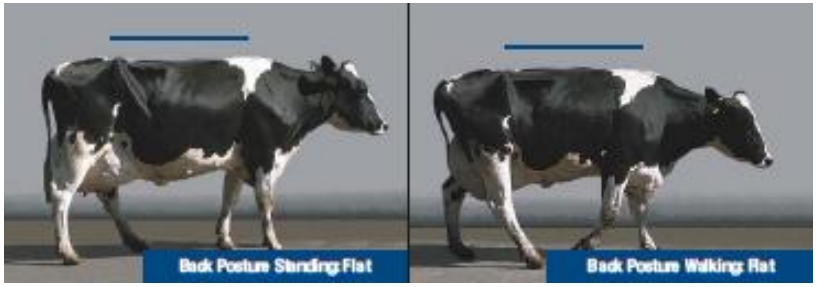
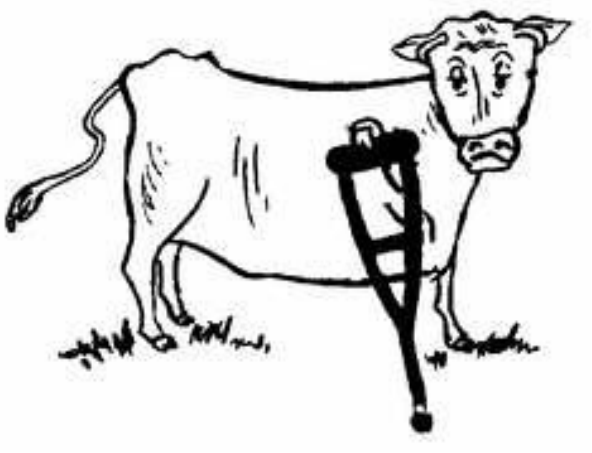
First study into the temporal relationship between metabolic disorders and lameness events over the course of a lactation

Axelle MINEUR [1], Christa EGGER-DANNER [2], Johann SÖLKNER [3], Sylvie VANDERICK [1], Hedi HAMMAMI [1], Nicolas GENGLER [1]



1 Universite de Liège (ULiège), Gembloux Agro-Bio Tech, Belgium
2 ZuchtData EDV-Dienstleistungen GmbH, Austria
3 University of Natural Resources and Life Sciences (BOKU), Austria

Lameness in dairy cattle

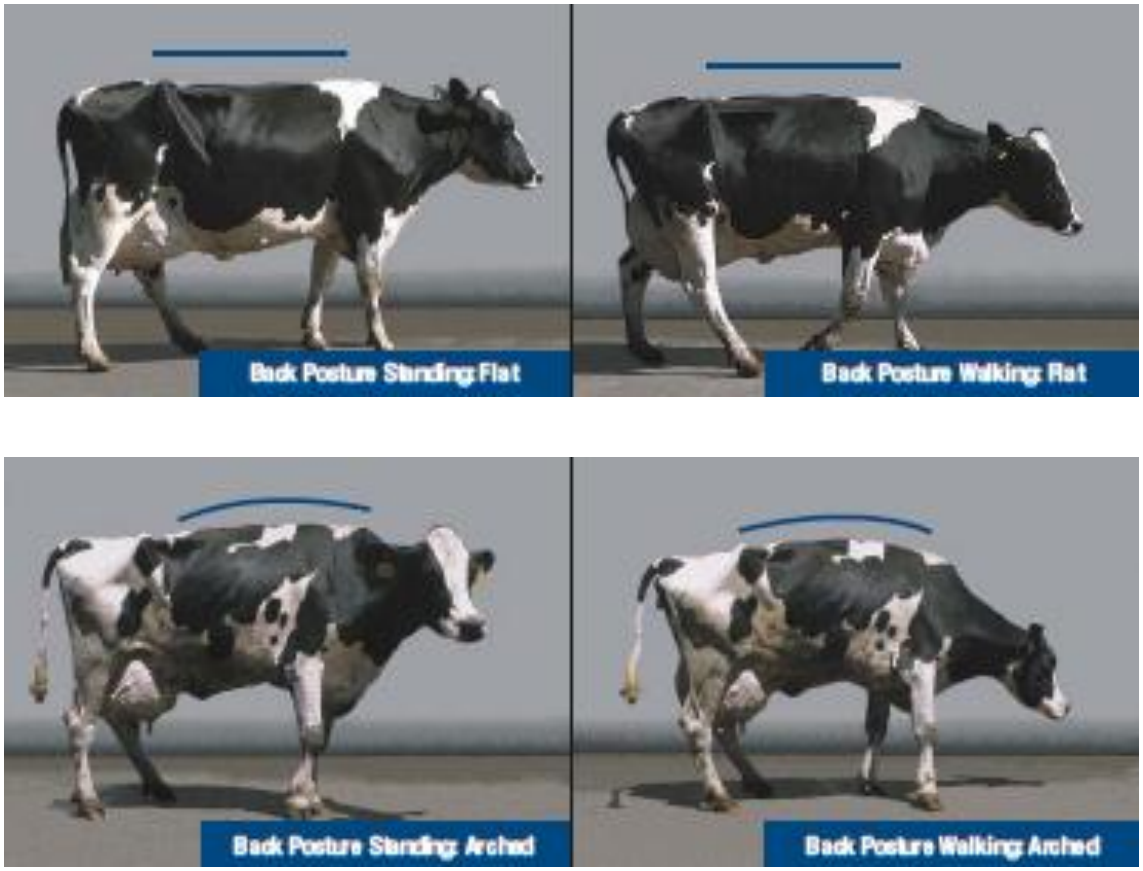


20 – 40 %

Medical repercussions

250 €

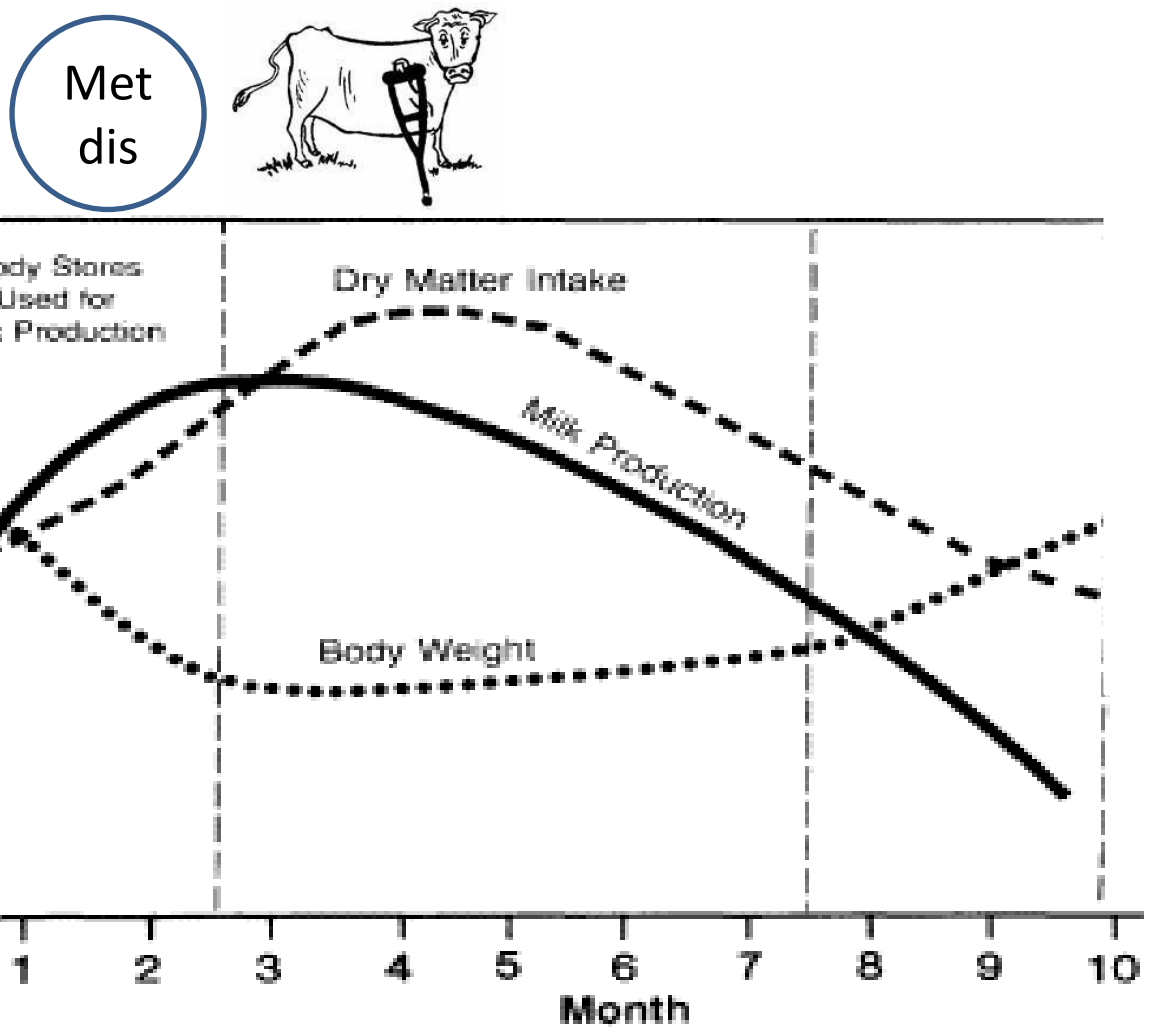
Visual evaluation => Locomotion scoring



! Labor & Time !

Possible causes of lameness

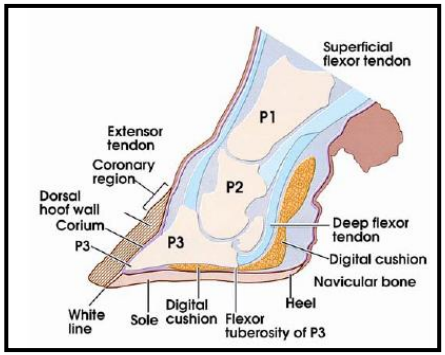
Metabolic disorder ⇔ Lameness event

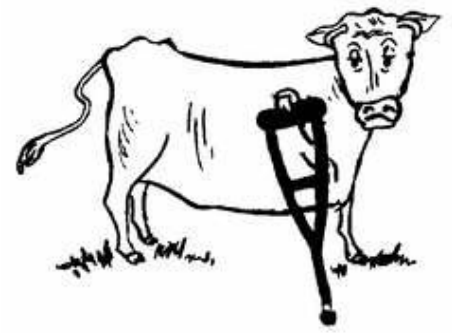


Biomarkers

BHB,
Acetone,
Citrates

NEB & ketosis



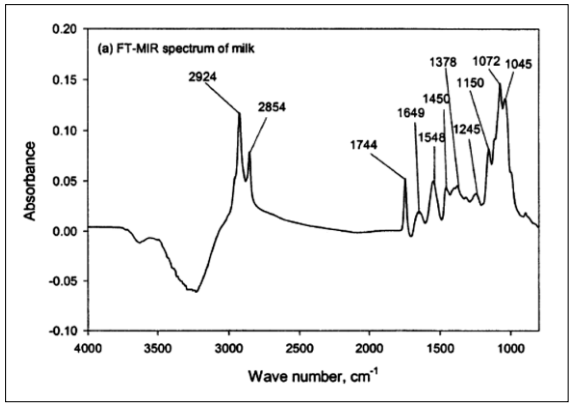


MIR predicted biomarkers

Milk samples

MIR analysis

MIR spectra



Calibration

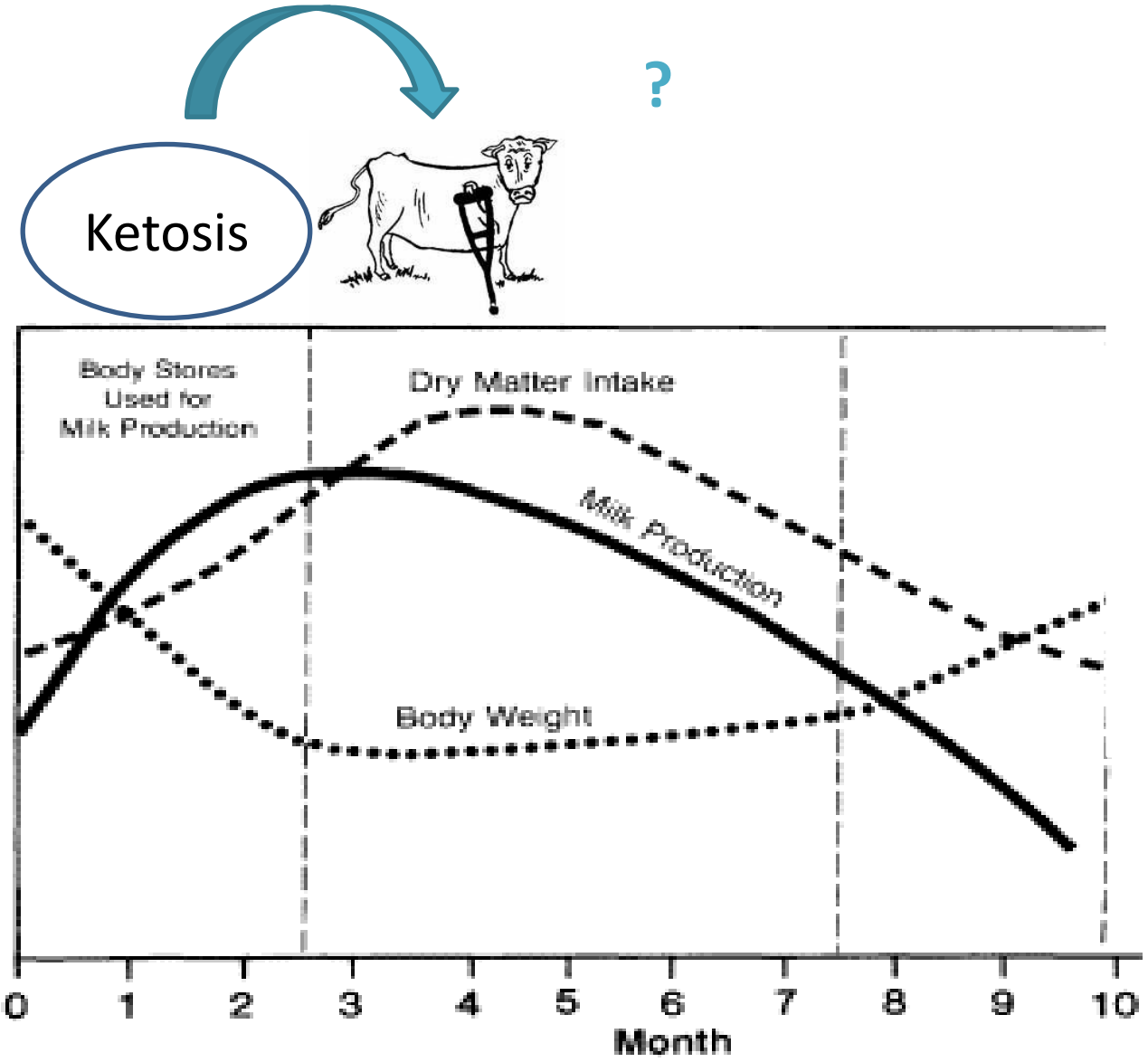
Prediction

Novel components

- BHB
- Acetone
- Citrates

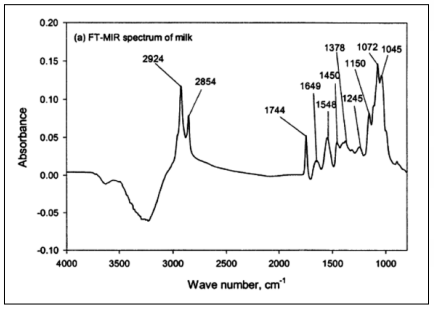
Reference values

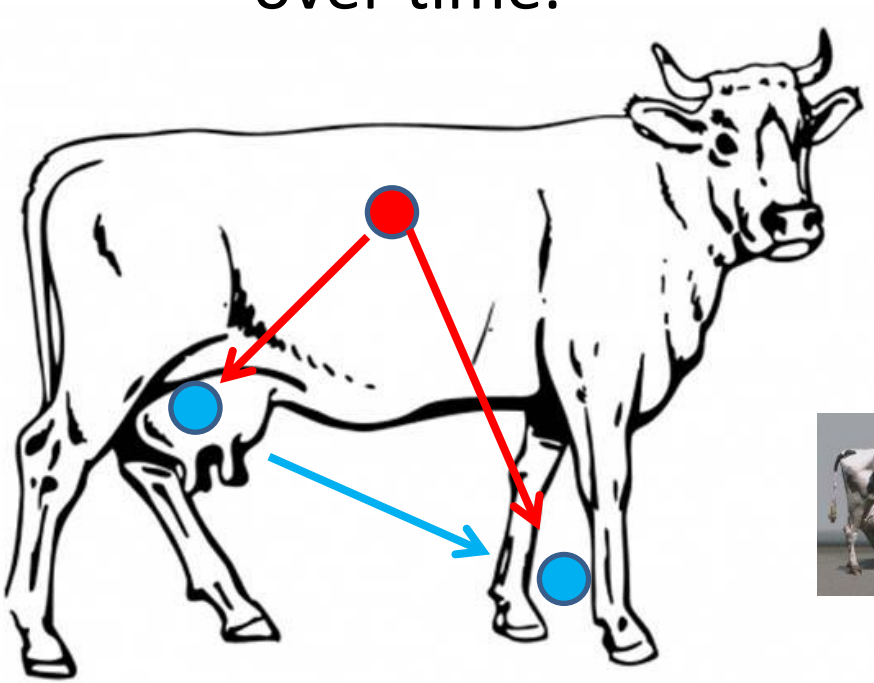
Temporal relationship



Hypothesis

There is a link between metabolic disorders and lameness, over time.





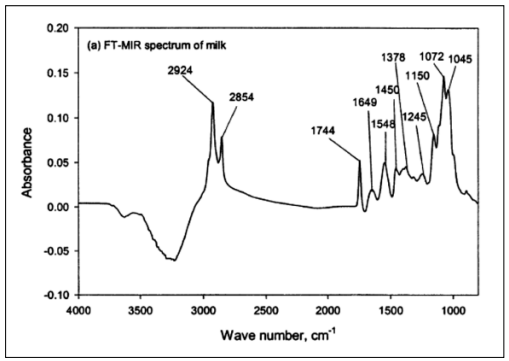
- BHB
- Acetone
- Citrates

Cheap & non-invasive & large-scale

Data availability

Austria →

- 9324 records
- 3895 cows
- 122 farms



- BHB
- Acetone
- Citrates

Method

Per breed: Simmental, Holstein, Brown Swiss

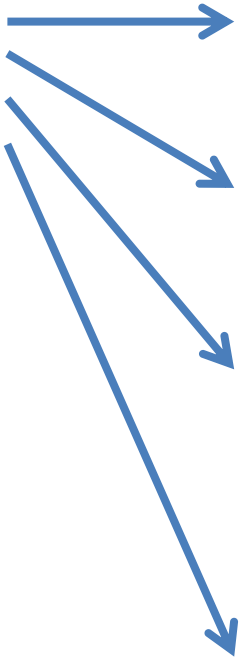
Lactation = 10 Lactation stage classes of 30 days

mean/animal/class

- BHB, acetone, citrate
- Lameness score

Method

Milk composition
(biomarkers in month 1)



Lameness status
(month 1)

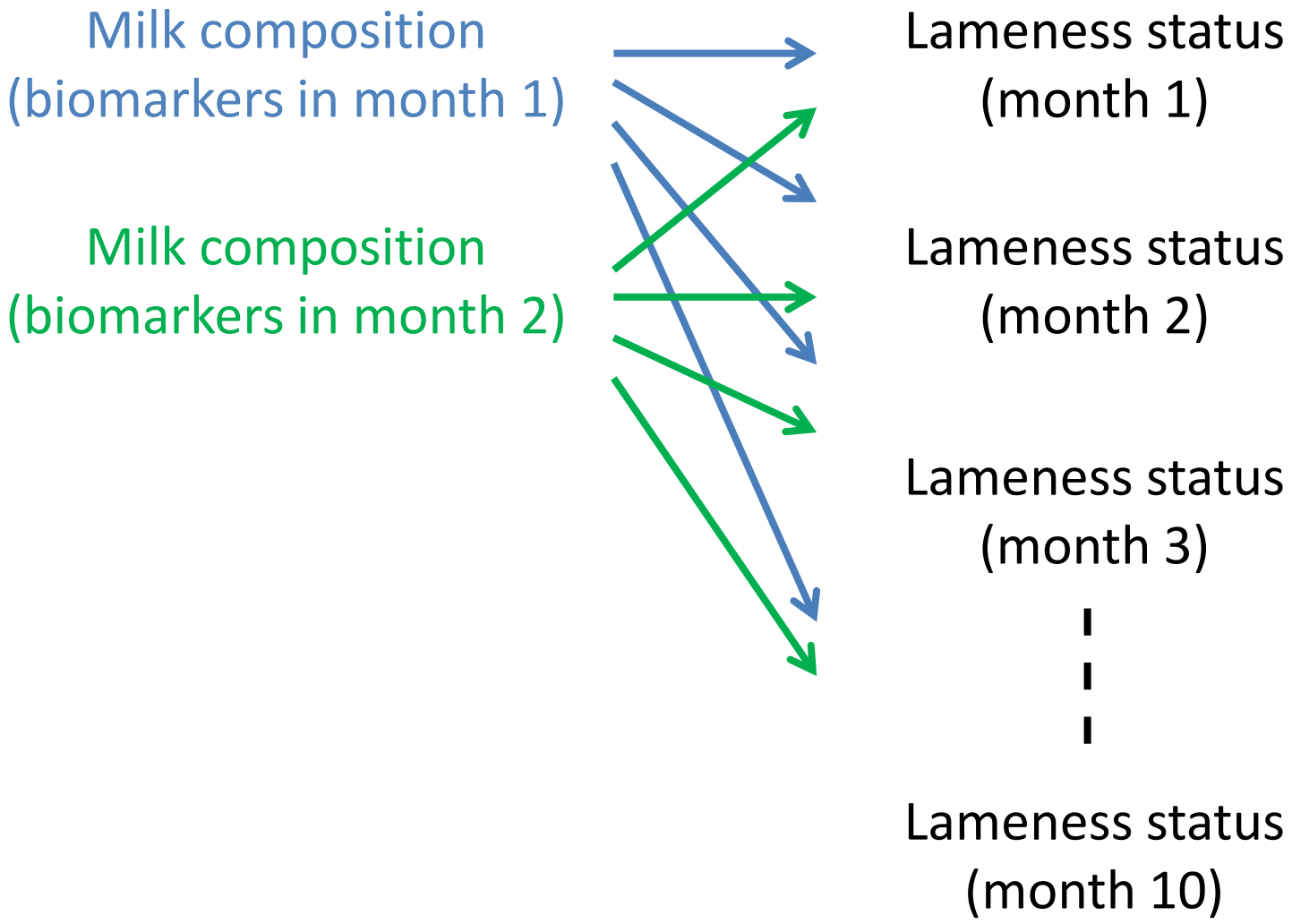
Lameness status
(month 2)

Lameness status
(month 3)

Lameness status
(month 10)

Correlations:
pair wise per animal

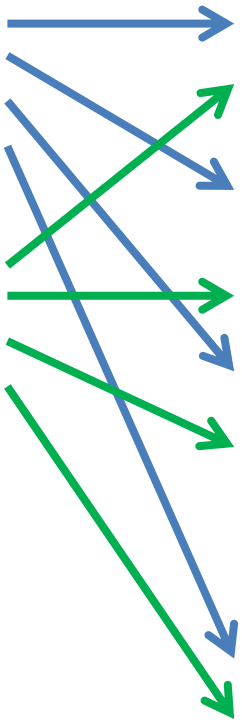
Method


Milk composition
(biomarkers in month 1)
Milk composition
(biomarkers in month 2)
Lameness status
(month 1)
Lameness status
(month 2)
Lameness status
(month 3)
Lameness status
(month 10)

Method

Milk composition
(biomarkers in month 1)

Milk composition
(biomarkers in month 2)



Lameness status
(month 1)

Lameness status
(month 2)

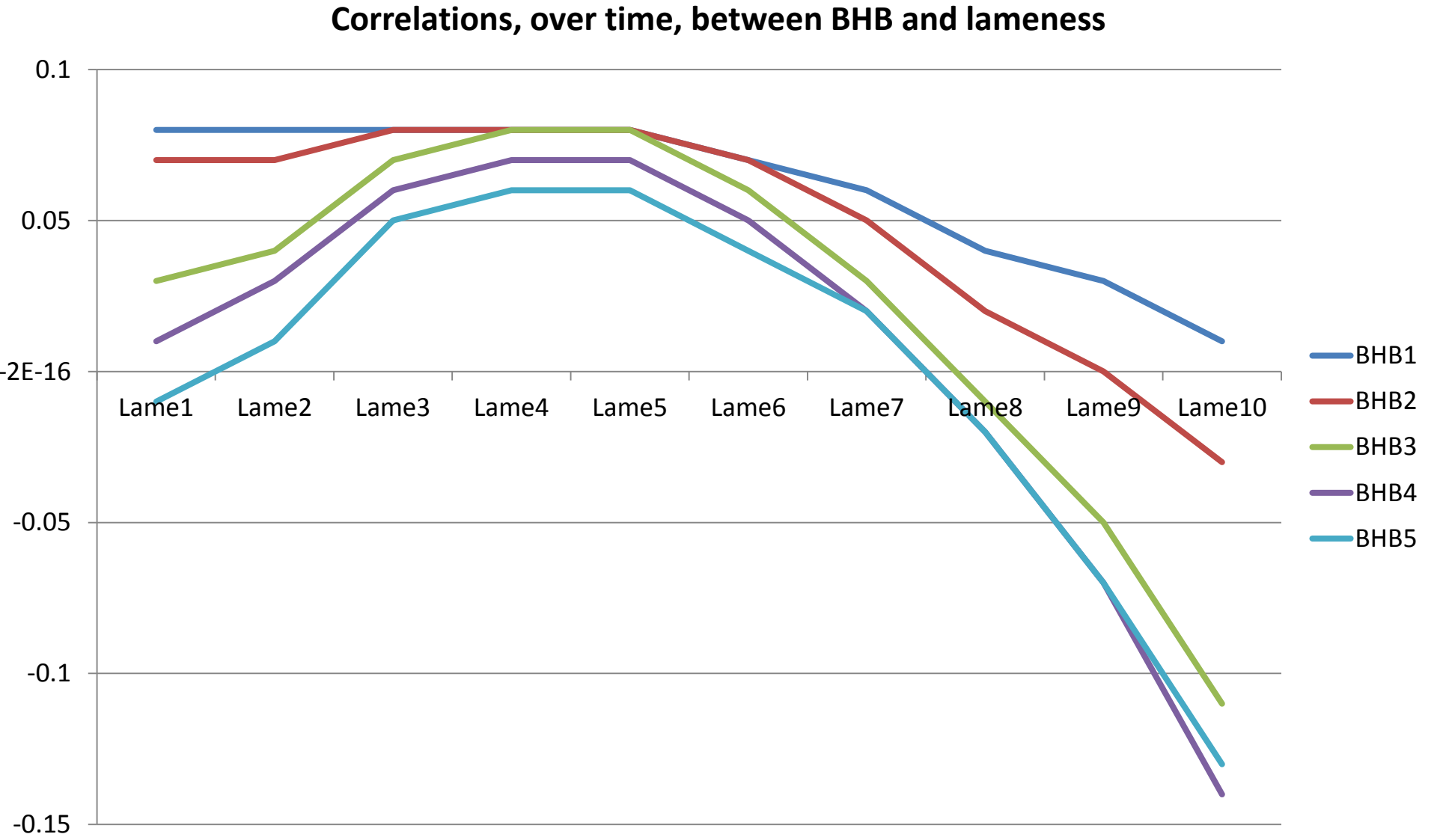
Lameness status
(month 3)

Lameness status
(month 10)

Correlation function
of 2nd order polynome

Smoothed results

FL	Lame1	Lame2	Lame3	Lame4	Lame5	Lame6	Lame7	Lame8	Lame9	Lame10
BHB1	0.08	0.08	0.08	0.08	0.08	0.07	0.06	0.04	0.03	0.01
BHB2	0.07	0.07	0.08	0.08	0.08	0.07	0.05	0.02	0.00	-0.03
BHB3	0.03	0.04	0.07	0.08	0.08	0.06	0.03	-0.01	-0.05	-0.11
BHB4	0.01	0.03	0.06	0.07	0.07	0.05	0.02	-0.02	-0.07	-0.14
BHB5	-0.01	0.01	0.05	0.06	0.06	0.04	0.02	-0.02	-0.07	-0.13
BHB6	-0.03	-0.01	0.03	0.04	0.04	0.03	0.02	-0.01	-0.05	-0.10
BHB7	-0.04	-0.02	0.00	0.02	0.02	0.02	0.02	0.01	-0.01	-0.03
BHB8	-0.05	-0.04	-0.03	-0.01	-0.00	0.01	0.02	0.03	0.04	0.05
BHB9	-0.06	-0.06	-0.06	-0.05	-0.03	-0.01	0.03	0.07	0.11	0.17
BHB10	-0.06	-0.07	-0.10	-0.09	-0.07	-0.03	0.03	0.10	0.20	0.31


Correlations, over time, between BHB and lameness
0.1
0.05
-2E-16
-0.05
-0.1
-0.15
Lame1
Lame2
Lame3
Lame4
Lame5
Lame6
Lame7
Lame8
Lame9
Lame10
BHB1
BHB2
BHB3
BHB4
BHB5

Limitations of the data

Size! Simmental: ~~9324~~ => 4775 samples

~~3895~~ => 1700 cows

FL	Lame1	Lame2	Lame3	Lame4	Lame5	Lame6	Lame7	Lame8	Lame9	Lame10
BHB1	120	44	41	40	51	40	39	35	37	41
BHB2	65	68	193	77	86	79	63	63	53	56
BHB3	36	41	75	150	69	47	49	54	45	46
BHB4	52	51	74	70	154	57	52	49	49	46
BHB5	55	44	83	63	70	154	52	46	53	54
BHB6	40	40	51	44	50	53	111	33	38	41
BHB7	36	32	58	52	53	60	46	125	39	39
BHB8	39	44	52	63	50	58	43	49	136	48
BHB9	36	41	41	50	57	59	46	41	51	121
BHB10	35	126	54	46	52	55	59	43	53	50

Variability! Only 8% of lame cows

Conclusions

- Start of lactation

- Next steps
  - Regression over time
  - Modelling: environment, herd, lactation number
  - Based directly on the milk spectra

- Lameness = complex => more data to cover variability

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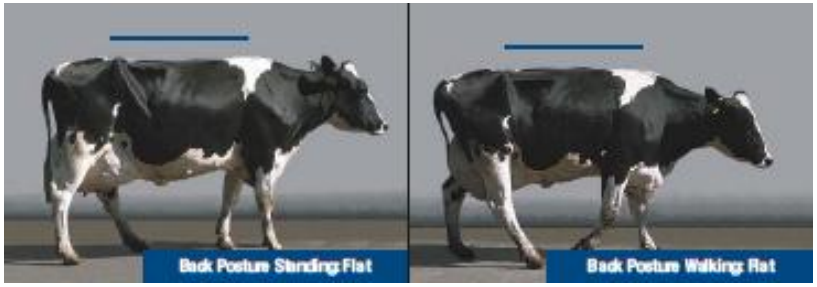

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