Relationships between subclinical ketosis, BCS, fat-protein-ratio and other diseases in Fleckvieh

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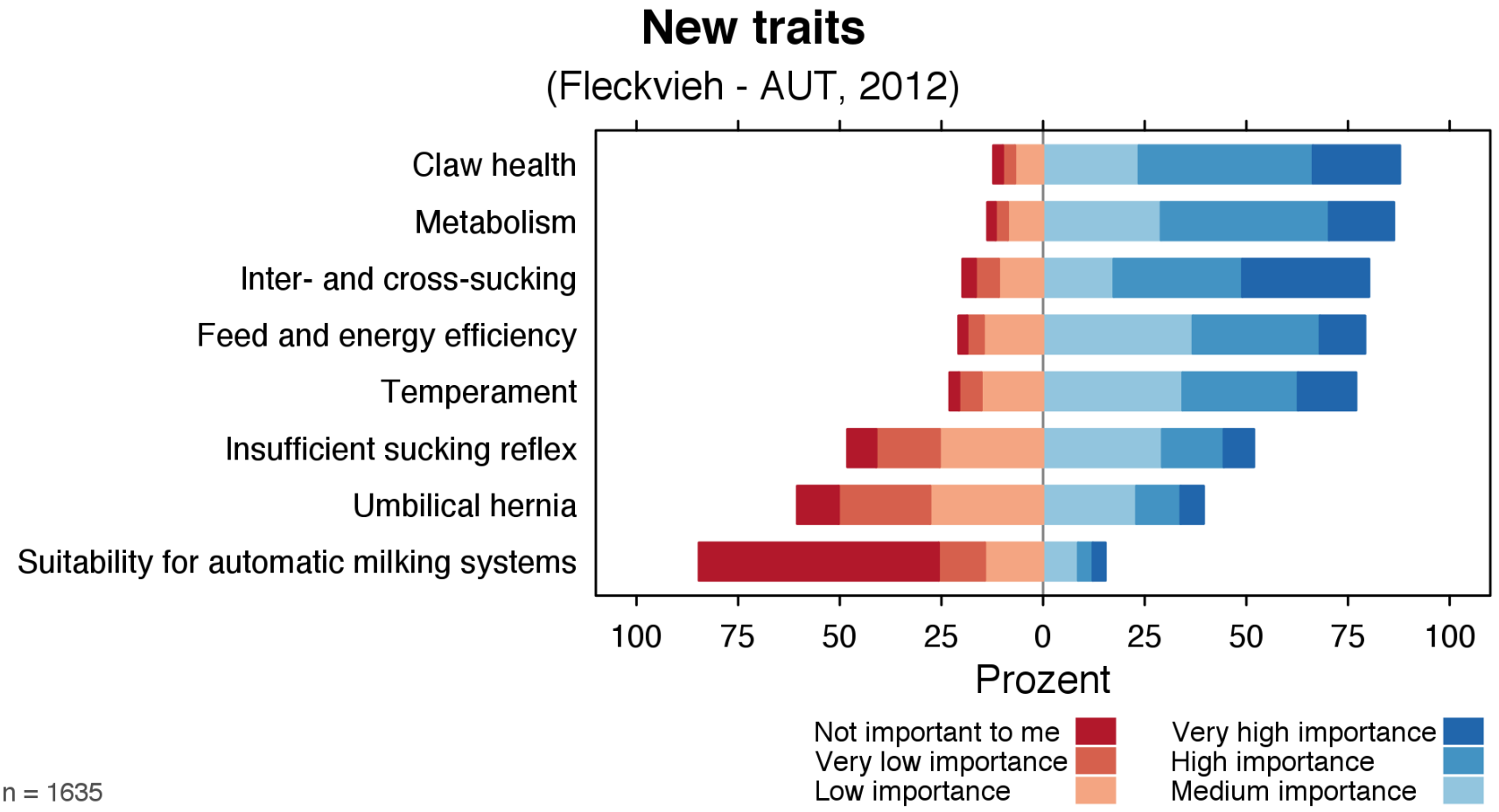
Photo: Rinderzucht Tirol

Background

- In 2006, Austrian health monitoring project was launched (Egger-Danner et al., 2012)
- Since 2010, **breeding values** for mastitis, early fertility disorders, cystic ovaries and milk fever have been published (Fuerst et al., 2011)
- Metabolism is currently covered only by the trait **milk fever**

„Wish list“ for new traits from farmers – Fleckvieh (Steininger, 2013)



n = 1635

Approach – field data for novel traits

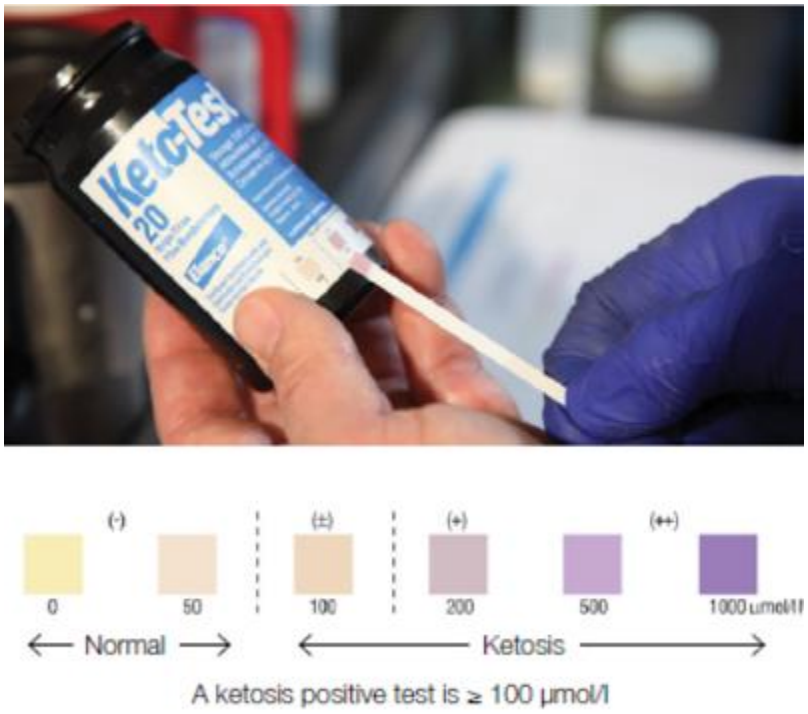
- Study based on data of Austrian project „**Efficient Cow**“
- Extended data recording on-farm on **161 farms in Austria** with app. 6,500 cows for one year (2014)
- **Data recorded**:
  - general information about the farm
  - various data related to health (e.g. veterinarian diagnoses, claw trimming, farmer observations, **subclinical ketosis**)
  - feeding information
  - body weight and body measures, linear scoring
  - **body condition score**, lameness
  - infrared-spectra
  - ...

Aim

- **Phenotypic** and **genetic** analysis of **subclinical ketosis**
- **Associations** with **BCS, ketosis, fat-protein-ratio** and other **diseases**

Subclinical ketosis

- Detected by using the **milk Keto-test** from ELANCO (measures **milk ß-hydroxybutyrate**) at **days 7** and **14** after calving



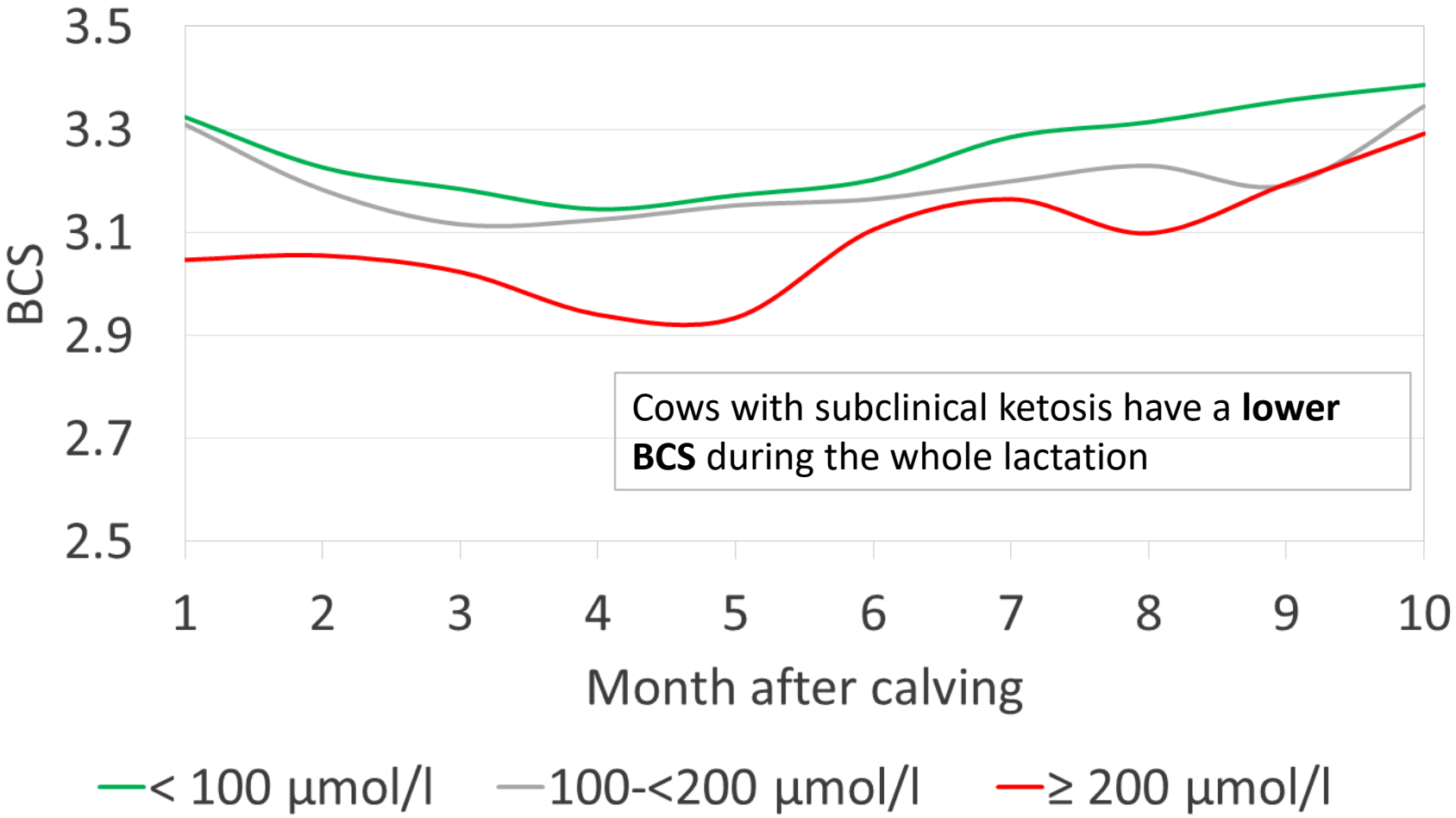
Phenotypic analysis

- Keto-Test results **7 days after calving** considered (N=1,920)
- Keto-Test results were grouped into **3 classes** according to their milk ß-hydroxybutyrate:
  - **healthy** = <100 µmol/l
  - **suspicious** = 100-<200 µmol/l
  - **subclinical ketosis** = ≥ 200 µmol/l

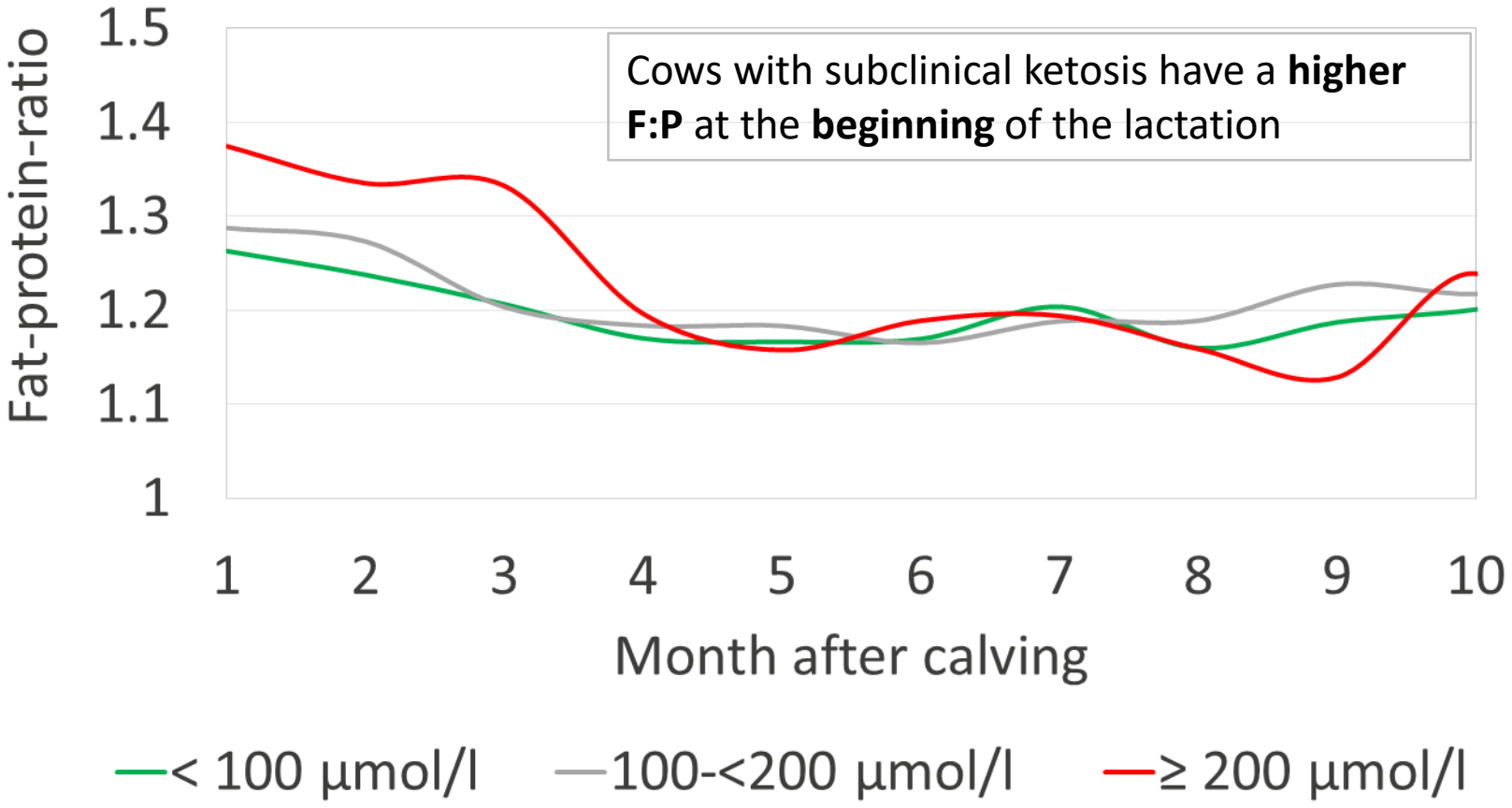
Frequency of subclinical ketosis (%)

Keto-test (N=1,920)	Parity			
	All	1	2	3+
< 100 µmol/l	64.2	71.9	68.5	58.0
100-<200 µmol/l	28.5	23.4	24.0	33.2
≥ 200 µmol/l	7.3	4.7	7.5	8.8

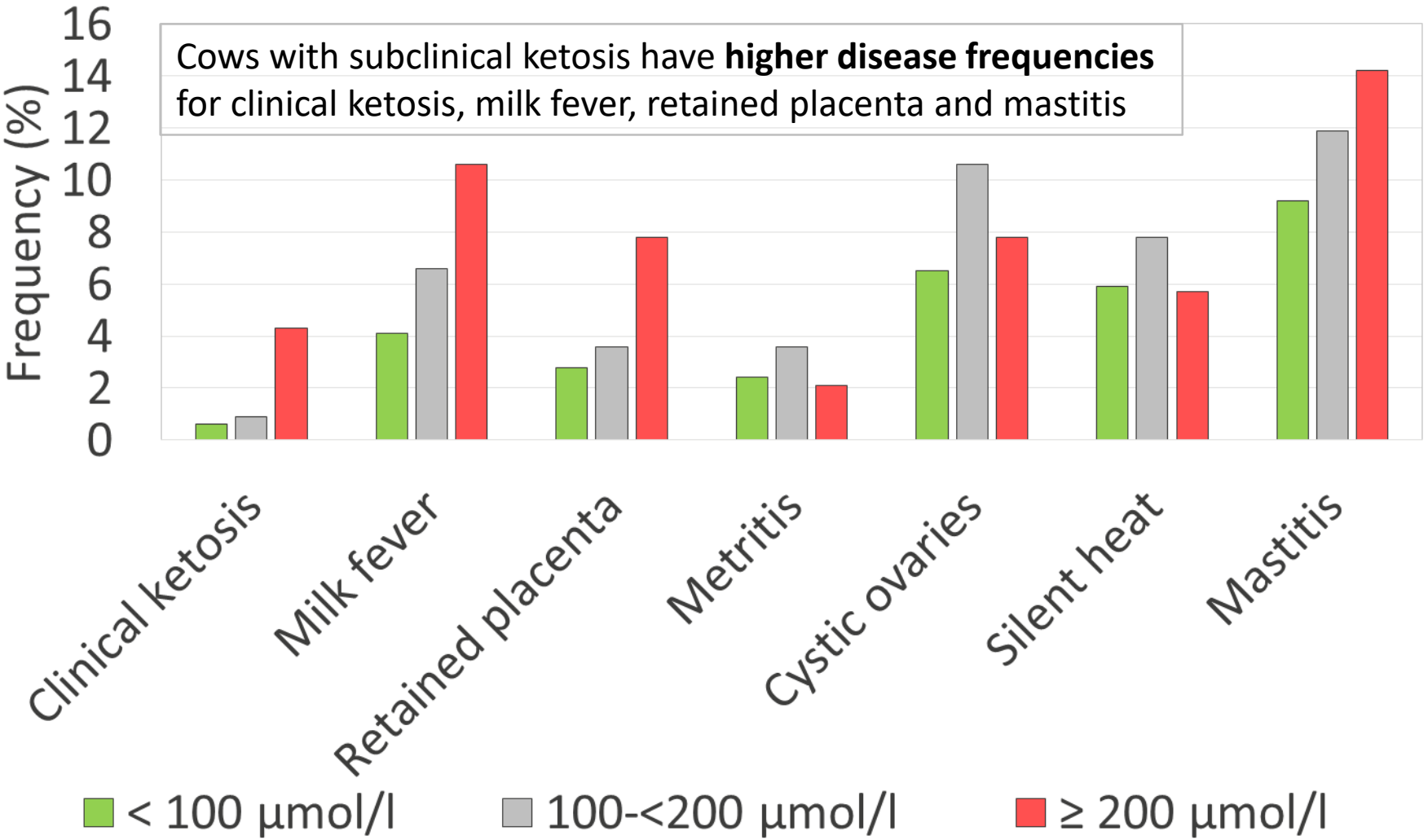
Subclinical ketosis and BCS



Subclinical ketosis and fat-protein-ratio



Subclinical ketosis and other diseases



Genetic analysis - Data

- **Keto-test** results 7 and 14 days after calving were combined (N=1,805); grouping as for phenotypic analysis (0/1/2)
- **Ketosis** (1-100 DIM) and **Milk fever** (-10 to 10 DIM) in years 2012-2014 (0/1)
- **BCS** and **Fat:Protein ratio** on 1st test-day

Summary statistics of data set

	Number of records	Mean
Subclinical Ketosis	1,805	0.56
Ketosis, %	5,670	0.70
Milk Fever, %	5,670	4.10
BCS	2,492	3.31
F:P	7,187	1.28

Genetic parameters (VCE6, Groeneveld et al., 2008)

	SUB KET	KET	MF	BCS	F:P
SUB KET	0.05 (0.029)				
KET		0.01 (0.006)			
MF			0.02 (0.027)		
BCS				0.17 (0.039)	
F:P	**Heritabilities** in accordance to **previous studies**				0.14 (0.026)

Genetic parameters (VCE6, Groeneveld et al., 2008)

	SUB KET	KET	MF	BCS	F:P
SUB KET	**0.05** **(0.029)**	0.89 (0.62)	0.51 (0.31)		
KET		**0.01** **(0.006)**	0.79 (0.32)		
MF			**0.02** **(0.027)**		
BCS				**0.17** **(0.039)**	
F:P	**Correlations** between **metabolic disorders** including sublinical ketosis **high**				**0.14** **(0.026)**

Genetic parameters (VCE6, Groeneveld et al., 2008)

	SUB KET	KET	MF	BCS	F:P
SUB KET	**0.05 (0.029)**	0.89 (0.62)	0.51 (0.31)	-0.45 (0.22)	0.16 (0.26)
KET		**0.01 (0.006)**	0.79 (0.32)	-0.99 (0.17)	-0.33 (0.41)
MF			**0.02 (0.027)**	-0.61 (0.36)	0.43 (0.26)
BCS	Animals with lower BCS are more susceptible to metabolic disorders			**0.17 (0.039)**	-0.26 (0.16)
F:P	Results for F:P difficult to interpret → in general high standard errors				**0.14 (0.026)**

Conclusions

- **BCS** is a **valuable tool** for the prevention and **early detection of metabolic diseases**
- Metabolism with subclinical and clinical symptoms is complex
- Different information sources and traits could be used to improve metabolic disease resistance
- Development of **Metabolism Index**?

Acknowledgements

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Thank you for your attention

Photo: Winter

Genetic analysis – Model (VCE6, Groeneveld et al., 2008)

- **Fixed effects/covariates:**
  - Year*season of calving
  - Parity-age at calving
  - Type of recording (for clinical ketosis and milk fever)
  - Days in milk (for BCS, F:P)
  - Day of first ketotest (for subclinical ketosis)
  - Number of ketotests (for subclinical ketosis)

- **Random effects:**
  - Herd*year
  - Animal (genetic effect)
  - Permanent environmental effect