FACULTY OF BIOSCIENCE ENGINEERING

DEPARTMENT OF ANIMAL SCIENCES AND AQUATIC ECOLOGY - LABORATORY FOR ANIMAL NUTRITION AND ANIMAL PRODUCT QUALITY

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THE TRANSITION PERIOD AS A MONITORING WINDOW FOR RESILIENCE OF HIGH YIELDING DAIRY COWS

INTRODUCTION

The transition period: the period of 60 to 90 days around calving

- crucial period for high yielding dairy cattle
- problems during transition can have significant negative effects on production, animal health and welfare
- negative energy balance is a challenge, some animals are more susceptible to develop transition problems: identifying in a preventive stage is necessary (value of biomarkers/sensors)

OBJECTIVES

Identifying risk animals for impaired metabolic health status, using sensor data and biomarkers

MATERIALS AND METHODS

Monitoring program at the ILVO research institute (37 cows)

- milk metabolites (morning milking; day 3 till 23 post partum (pp))
  protein, lactose, urea, cell count, fatty acids and ketones
- milk production (day 3 till 23 pp)
- feed intake (day 3 till 23 pp)
- blood metabolites (day -7, 3, 6, 9, 21)
  non-esterified fatty acids (NEFA), β-hydroxybutyric acid (BHB) and glucose
- sensor data (day 3 till 23)
  activity (IceTag©) (n=35), body condition and weight

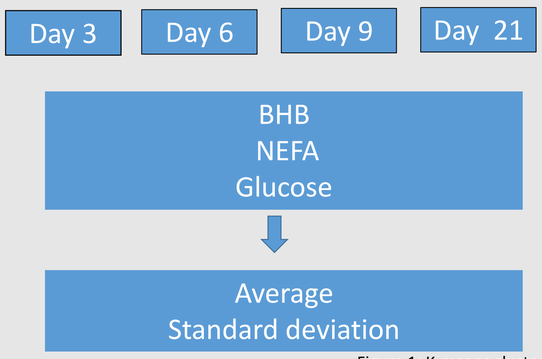

Figure 1: K-means clustering approach

RESULTS AND DISCUSSION

K-means clustering

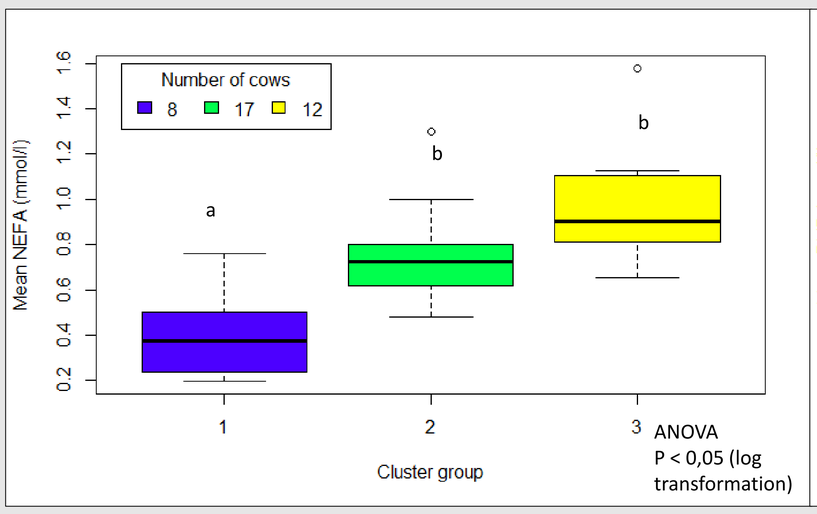

Figure 2: Mean serum NEFA-concentration (day 3, 6, 9 and 21 pp) of the clusters

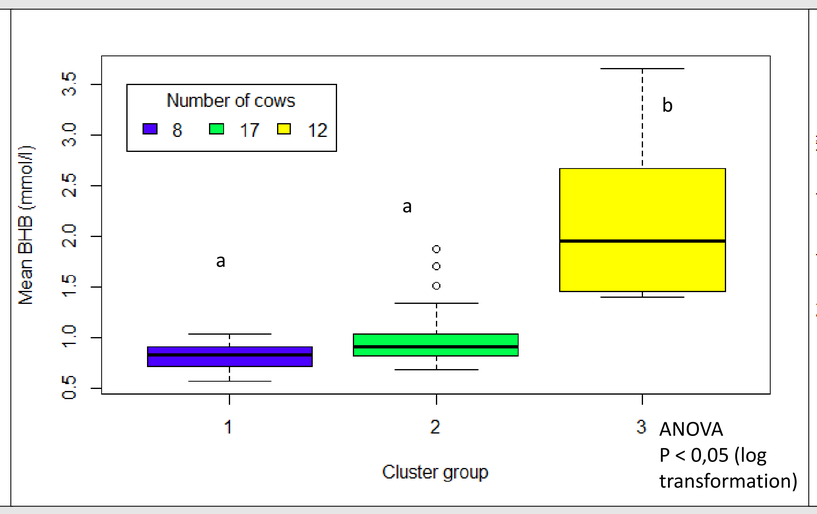

Figure 3: Mean serum BHB-concentration (day 3, 6, 9 and 21 pp) of the clusters

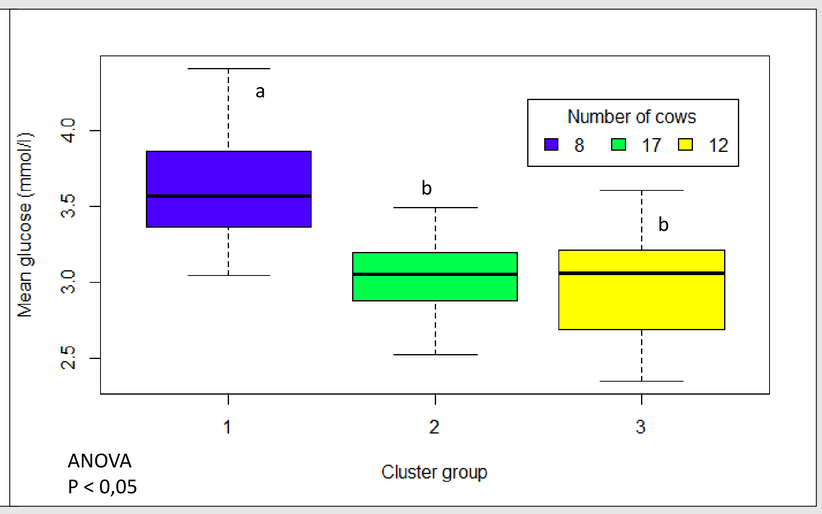

Figure 4: Mean plasma glucose concentration (day 3, 6, 9 and 21 pp) of the clusters

Interpretation metabolic status of cows in 3 clusters → cluster 1 good | cluster 2 intermediate | cluster 3 worse

Feed intake, milk yield and body weight

Table 1: Feed intake (kg fresh matter) and fat protein corrected milk (FPCM) morning yield (kg) (mean day 3 until 23 pp)

	good	intermediate	worse	p-value
Feed intake	48,8^{a} ± 11,1	47,1^{a} ± 5,7	35,7^{b} ± 7,9	P<0,05
FPCM yield (morning)	20,5 ± 3,3	23,5 ± 2,7	21,3 ± 4,2	P=0,08
Fat/protein ratio	1,28^{a} ± 0,12	1,47^{ab} ± 0,18	1,65^{b} ± 0,25	P<0,05

Milk composition

Table 2: Preliminary results of milk fatty acids analysis (g/100 g fatty acids) (n=18) (mean day 3, 6, 9 and 21 pp)

	good (3)	intermediate (7)	worse (8)	p-value
C15:0	0,84^{a} ± 0,22	0,63^{ab} ± 0,11	0,48^{b} ± 0,09	P<0,05
C18:1 (cis 9)	18,5^{a} ± 5,57	25,4^{b} ± 2,96	29,8^{c} ± 2,54	P<0,05

Activity

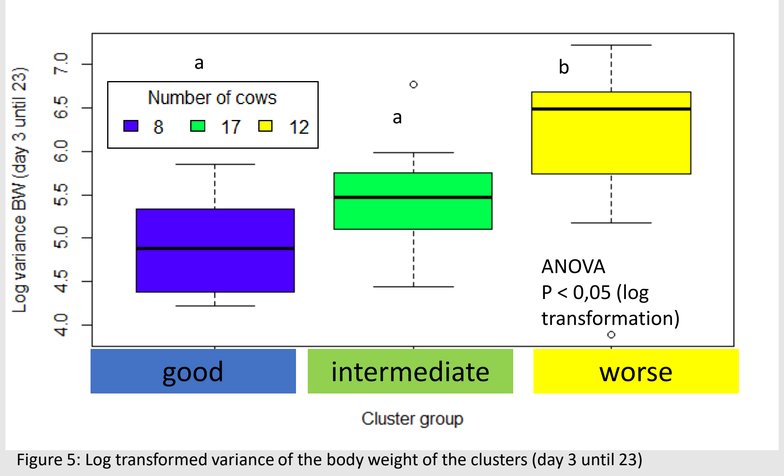

Figure 5: Log transformed variance of the body weight of the clusters (day 3 until 23)

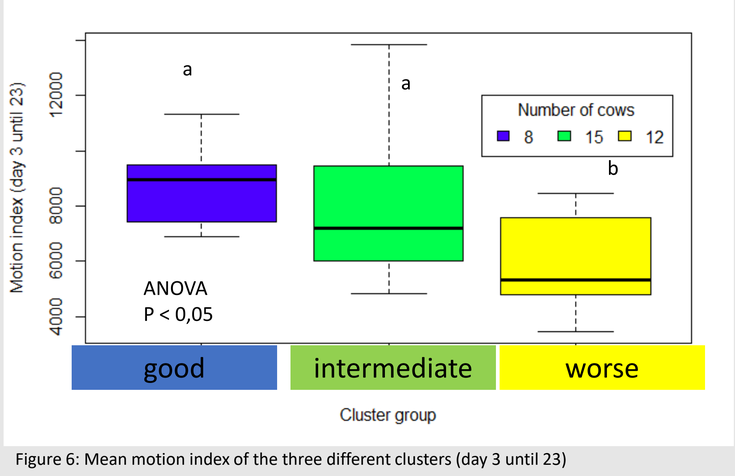

Figure 6: Mean motion index of the three different clusters (day 3 until 23)

Take home message

Cows with imbalanced metabolic profile:

- lower feed intake
- lower motion index
- equal FPCM yield

- milk composition:
  - higher fat/protein ratio
  - lower C15:0
  - higher C18:1 (mobilization)

CONCLUSION/FUTURE RESEARCH

Cows with an imbalanced metabolic profile between 3 days pp until 3 weeks pp are characterized by lower feed intake, higher variance in body weight and lower motion index during the first three weeks of the lactation. Despite their metabolic imbalance the cows are not characterized by a lower FPCM yield. Moreover the fat/protein ratio is a useful indicator to trace cows with severe negative energy balance. Finally the preliminary results clearly show differences in milk fatty acids composition. Further research is necessary to determine which sensor/biomarkers could be combined in order to trace metabolically less resilient cows.

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