University of Veterinary Medicine Budapest

Response to ACTH challenge test in lame and non-lame dairy cows

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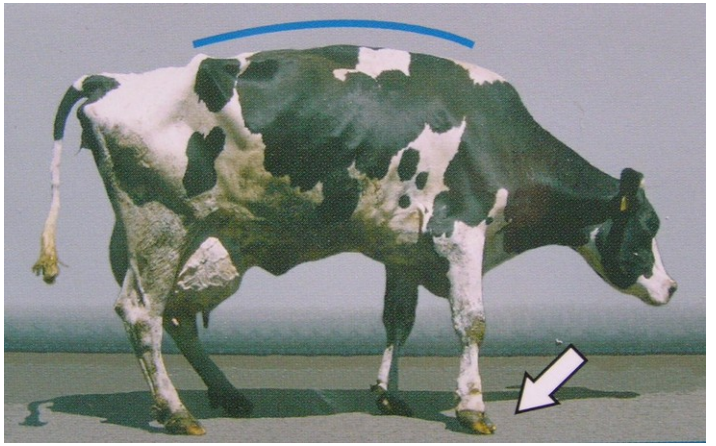
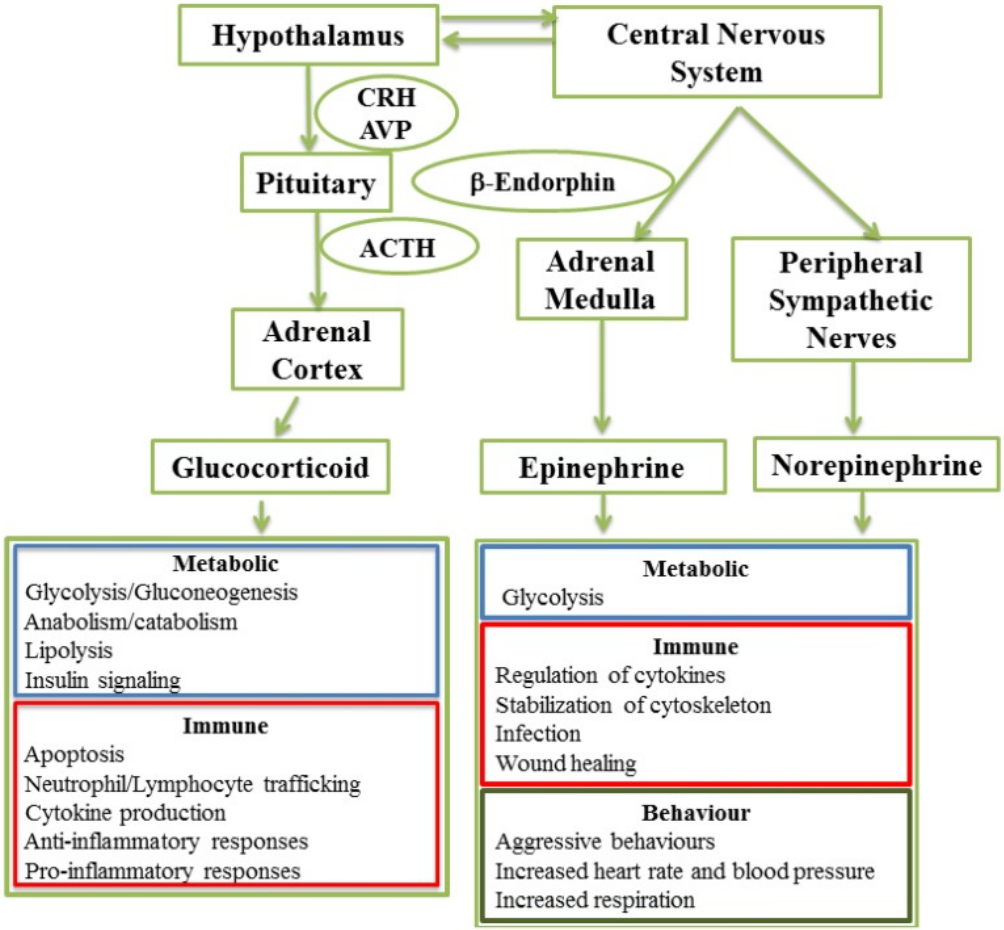
Lameness...

- is the number one welfare issue in dairies (Ventura et al., 2015)
  - painful,
  - leads to culling,
  - impacts production,
  - has a high prevalence and long duration,
  - and negatively affects public perception
- is often considered to be chronic stress (Thomas et al., 2016)



Stress

- Acute
  - Fast responses of the hypothalamic-pituitary-adrenal (HPA) axis and
  - sympathetic-adrenal-medullary (SAM) axis (Chen et al., 2015)
- Chronic
  - The effects are not so clear
  - Sensitization, desensitization and normalization may also occur, depending on the
    - intensity,
    - duration,
    - predictability and
    - type of stressor, and
    - interstressor interval (Ladewig, 2000)



(Chen et al., 2015)

Aim, hypothesis

- The aim of our study was to test the responses of chronically lame cows to an acute stressor (ACTH challenge)
- Hypothesis: lame cows respond differently compared to the control cows

Material and methods

- Based on locomotion scores (LS), we selected 11 chronically lame (LS: 3-5) and 11 non-lame (control, LS:1-2) animals
- The cows were paired according to their
  - lactation number: 4.1 ± 1.0 vs. 4.3 ± 1.6;
  - DIM: 190 ± 78 vs. 167 ± 73,
  - milk yield (L): 31.8 ± 3.6 vs. 32.1 ± 7.0).

- interdigital phlegmone, toe necrosis, sole ulcer, white line abcess were seen on the lame animals

Material and methods

- Blood samples were taken for basic comparisons
  - metabolic parameters
  - haptoglobin
  - cellular immune response by lymphocyte stimulation
- Hair was also sampled for cortisol assay.
- Body condition was scored

Material and methods

- 2nd and 3rd day of the experiment: ACTH challenge
- Blood samples were taken for cortisol assay
  - 30, 15 and 0 minutes prior to
  - and 10, 20, 30, 40, 60, 120, 180 and 240 minutes after administering 60 µg synthetic ACTH (tetracosactide, Synacthen inj.)

The cows were fixed in headlocks. TMR was offered ad libitum, water was offered from buckets 3x during the experimental period (after min 60, 120 and 180).

Material and methods

- Heart rate variability (HRV) of each animal was also recorded by Polar heart rate monitors throughout the 2 experimental days
  - HR recording started 1 hour prior to the 1st blood sampling
  - and lasted 20 min after the last sampling
- To represent vagal tone, the high frequency (HF) parameter of HRV was calculated in normalized units (n.u.).

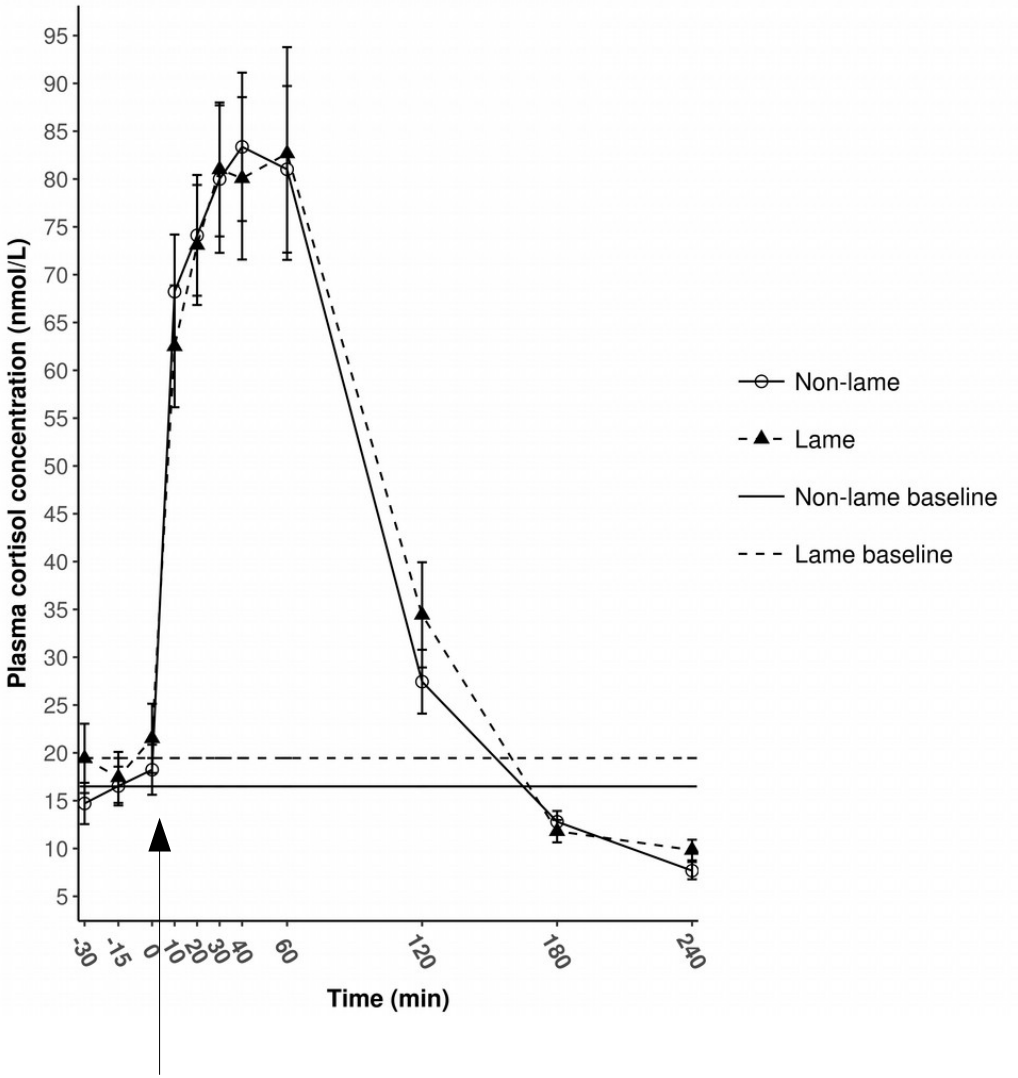
Results – basic parameters

- Difference in
  - hair cortisol
  - locomotion score
  - body condition score
- No difference in
  - haptoglobin
  - metabolic parameters
  - lymphocyte stimulation

	Lame	Non-lame
Hair cortisol (ng/g)	13.3 ± 3.2[a]	10.2 ± 2.8[b]
LS	4.2 ± 0.7[a]	1.6 ± 0.5[b]
BCS	2.2 ± 0.4[a]	2.6 ± 0.4[b]
Blood plasma samples		
Haptoglobin (mg/ml)	3.0 ± 1.1	2.8 ± 0.7
Glucose (mmol/l)	2.8 ± 0.4	2.8 ± 0.3
BHB (mmol/l)	0.6 ± 0.3	0.6 ± 0.2
AST (U/l)	106 ± 25	134 ± 40
Urea (mmol/l)	4.8 ± 0.5	4.9 ± 0.8
Lymphocyte stimulation		
Lectin	1.1 ± 0.4	1.0 ± 0.1
PHA	0.9 ± 0.1	1.0 ± 0.1
ConA	1.1 ± 0.2	0.9 ± 0.1

Blood cortisol concentrations

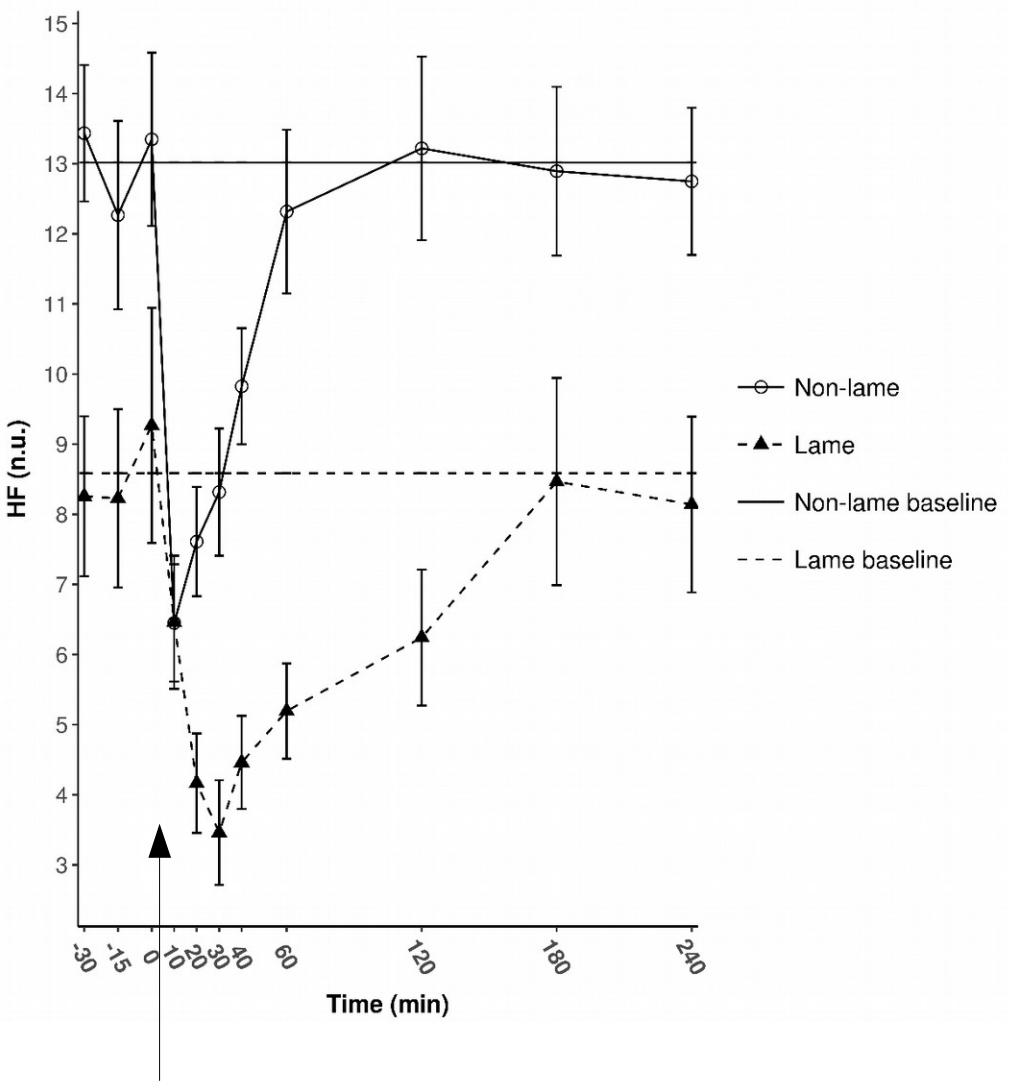
- No differences in plasma cortisol concentrations
  - prior to (baseline) and
  - after ACTH administration
    - maximum value,
    - amplitude of the response,
    - area under the curve,
    - return to the baseline and
    - time to reach peak value



ACTH administration

Heart rate variability

- Lame animals had <u>lower HF baseline values</u> indicating lower parasympathetic tone, presumably caused by stress and pain induced by standing.
- After injecting ACTH, HF decreased in both groups. It reached its minimum and returned to baseline with a delay in lame animals.



ACTH administration

Conclusions

- Chronic lameness, although long lasting and painful, shows inconsistent results regarding the physiological signs of stress.
- Lameness seems to be a chronic intermittent stressor: an irregular application of a homotypic stressor. (Ladewig, 2000)
- The time between stress exposures is a very important factor when considering the damaging effects of stress. During the intermissions between stress exposures the organism may recuperate. (Ladewig, 2000)
- From a practical point: Early and effective treatment, and RESTING are both important.

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