Stress in riding horses

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Effect of Head-and-Neck-Position on acute stress responses in dressage horses

(Christensen et al, under review)

• 15 Danish dressage horses
  – Intermediate to high level
  – Routinely trained in LDR
  – Ridden 3 times by their usual rider
  – Balanced across three test days

HNPs according to Elgersma et al. 2010
Material & Methods

Parameters

• Cortisol in saliva
  – -60, 0, 5, 15, 30 min

• Heart rate & heart rate variability
  – HR, RMSSD, LF/HF ratio

• Head and Neck angle
  – Anatomical markers

• Behaviour
  – Video recordings

• Rein tension
  – SignalScribe™, sensor limit=5kg
Protocol

Standard riding arena (20x60m)
Results

Loose frame | Competition frame | Low, Deep & Round

Rein tension

![Graph showing average rein tension with comparison between different frame types. The graph indicates significant differences with p ≤ 0.001.](attachment:graph.png)
Results - Rein tension

Ceiling effect RT

** p ≤ 0.01
Results - Cortisol

Difference from baseline

![Graph showing cortisol levels over time with annotations and error bars.](image-url)
Results - Behaviour

Conflict behaviour – head (freq)
Results - Behaviour

Conflict behaviour – mouth (freq)

Corrected for time visible (#/sec)

* p<0.05
Results - Behaviour

Head waving (duration)

Total duration in seconds
Results - Other

No significant difference in:

• Heart rate
• Heart rate variability
• Other behavioural categories
  o Tail lashing
  o Bucking, rearing and breaking gait
Conclusion

- Cortisol & behaviour point in same direction
- No differences in e.g. HR/HRV
  - 9 min trot/canter inappropriate?
  - Control frame unusual
  - Too few horses?
- Combined results indicate that being ridden 10 min in LDR may be perceived as more stressful for horses in this experimental set-up.
Behaviour and stress responses in horses with gastric ulceration

(Malmkvist et al, Appl Anim Behav Sci, 2012)

High prevalence of gastric ulceration

Racehorses (n=345): 86 %  
(Begg & O’Sullivan 2003)

Endurance horses (n=30)

• Competition season: 93 %  
• Outside this season: 48 %  
(Tamzali et al. 2011)

Riding horses (n=201): 53 %  
(Luthersson et al. 2009)
High prevalence of gastric ulceration

- Consequences for the horse?

"In pain"

"Poor body condition"

"Resistance during girth tightening"

"Uncooperative"

"Fatigue"

"Playing with food"

"Abnormal behaviour"

"Loss of appetite"

"Increased sensitivity"
Aim

- Horses with severe gastric ulceration
  - in a poor body condition?
  - more abnormal behaviour?
  - higher baseline of stress hormones?
  - different behaviour during feeding?
  - react differently in fear test?
Study design

• 100 Danish Warmblood dressage/jumping horses at one stud

• Gastroscopic examination

  Equine Gastric Ulceration Syndrome score
  = EGUS score (Andrews et al. 1991)

Method: Luthersson et al. 2009
Score 0: Healthy mucosa

Score 4: Extensive lesions with areas of apparent deep ulceration

• Two regions of stomach scored
  I. Upper non-glandular part
  II. Glandular part
Regions of stomach scored

I. Squamous Mucosa

II. Glandular Mucosa

Margo Plicatus

Pylorus

Esophagus

Duodenum
EGUS score

I. Upper non-glandular part of stomach

Score 3
II. Glandular part of stomach

EGUS score

Score 3
Non-glandular gastric ulceration exposure to gastric acids during exercise in horses (e.g. Tamzali et al. 2011)

Glandular gastric ulceration has been related to stress in other species (e.g. Selye, 1936; Weiss 1968)
EGUS score

Proportion of horses, %

I. Non-glandular mucosa
II. Glandular mucosa

Score 2-4
41 %
55 %

Ulcer horses
n = 30

Intact mucosa
EGUS score

Controls, n = 30

Study design – experimental groups
Controls, n = 30
# Study design

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Ulcer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glandular score</strong></td>
<td>0-1</td>
<td>3-4</td>
</tr>
<tr>
<td><strong>Non-gland. score</strong></td>
<td>0-1</td>
<td>0-3</td>
</tr>
<tr>
<td><strong>Age, years</strong></td>
<td>7 (0.7)</td>
<td>7 (0.4)</td>
</tr>
<tr>
<td><strong>Mare:Gelding:Stallion</strong></td>
<td>6:8:16</td>
<td>5:13:12</td>
</tr>
<tr>
<td><strong>In training</strong></td>
<td>67%</td>
<td>77%</td>
</tr>
<tr>
<td><strong>Starch, g/kg BW</strong></td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Hay per day, kg</strong></td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Body condition score</strong></td>
<td>5 [4; 5]</td>
<td>5 [5;5]</td>
</tr>
</tbody>
</table>
**Behaviour during feeding**

- 1h observation. A feed teaser after 30 min.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Control</th>
<th>Ulcer</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time spent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- eating teaser</td>
<td>126 (10)s</td>
<td>94 (11)s</td>
<td>0.025 *</td>
</tr>
<tr>
<td>- locomotion</td>
<td>4 (1.1) %</td>
<td>2 (1.2) %</td>
<td>0.030 *</td>
</tr>
</tbody>
</table>

- NS. difference in occurrence of abnormal behaviour
# Novel object test

- In home box, 10 min test time

<table>
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<th>Behaviour</th>
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<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latency to touch</td>
<td>100 s</td>
<td>102 s</td>
<td>0.98 NS</td>
</tr>
</tbody>
</table>

Time spent
- away 32 % 49 % 0.081 (*)
- in object contact 27 % 23 % 0.49 NS
## Novel object test

- In home box, 10 min test time

<table>
<thead>
<tr>
<th>Heart rate</th>
<th>Control</th>
<th>Ulcer</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>72 (3.4)</td>
<td>69 (3.7)</td>
<td>0.53 NS</td>
</tr>
<tr>
<td>Mean</td>
<td>45 (1.3)</td>
<td>43 (1.3)</td>
<td>0.32 NS</td>
</tr>
</tbody>
</table>

Fearfulness did not differ
**Stress hormones (FCM)**

FCM: Faecal Cortisol Metabolites, reflecting blood cortisol with a 24 h time-lag (Palme et al. 1996)

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<th>Ulcer</th>
<th>P-value</th>
</tr>
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<tbody>
<tr>
<td><strong>FCM, ng/g</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>5.3 (1.9)</td>
<td>5.7 (2.0)</td>
<td>0.79 NS</td>
</tr>
<tr>
<td>Response to NOT</td>
<td>5.8 (0.8)</td>
<td>7.3 (0.8)</td>
<td>0.018 *</td>
</tr>
</tbody>
</table>

Increased stress hormone response in ulcer horses
Conclusion

Horses with severe glandular ulceration:

• no clear outer signs  
  (e.g. body condition, crib biting, fearfulness)

• differ in behaviour around feeding

• same stress hormone baseline as controls

• more stress sensitive, as they responded with a higher FCM concentration after a novelty test
Overall conclusion

• A combination of behavioural and physiological parameters is useful for evaluation of stress in riding horses
- 27% lesions (score 2-4) in both non- and glandular part
- 33% no lesions (score 0 – 1)
Risk factors include feeding management: amount of starch, availability and type of forage (e.g. Luthersson et al. 2009)

Humans: link with *Heliobacter pylori*,