



Non-invasive methods of welfare assessment in sheep and cattle

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Overview

- Pain in farm animals
- Non-invasive welfare indicators
- Protocol for on-farm assessment of sheep welfare





Pain in farm animals

- Important public concern with regards to animal welfare
- The ability to quantify the degree of pain experienced by animals is an important component in the assessment of animal welfare
- There is a need for scientifically based indicators to assess animal welfare



Pain definitions

- An unpleasant **sensory** and **emotional** experience associated with actual or potential tissue damage, or described in terms of such damage (IASP, 1979)
- An aversive **sensory** and **emotional** experience representing an awareness by the animal of damage or threat to the integrity of its tissues; it changes the animal's **physiology** and **behaviour** to reduce or avoid damage, to reduce the likelihood of recurrence and to promote recovery (Molony and Kent, 1997)



Physiological systems used to assess pain

- Sympathetic-adrenomedullary system
 - “fight or flight”
 - catecholamines – adrenaline and noradrenaline
- Hypothalamo-pituitary-adrenocortical system (HPA-axis)
 - cortisol
 - adrenocorticotrophic hormone

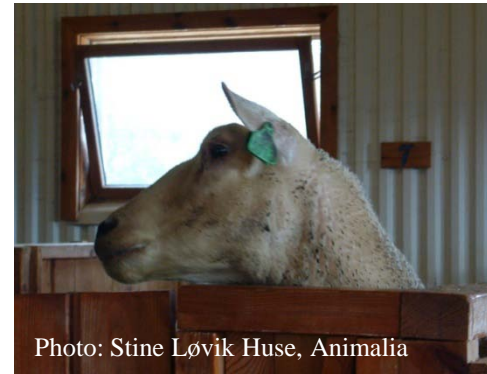
Pain assessment

Physiological measures:

- Blood hormones – eg. nor-adrenaline, adrenaline, cortisol
- Heart rate, heart rate variability, respiration, muscle tremor, body temperature, immune responses

Behavioural measures:

- Vocalisation – eg. howls, grunts, moans
- Posture – eg. crouches, huddled, hiding, lying
- Locomotion – reluctant to move, falls, pacing, restless
- Temperament – withdrawn, depressed, quiet, frightened, aggressive

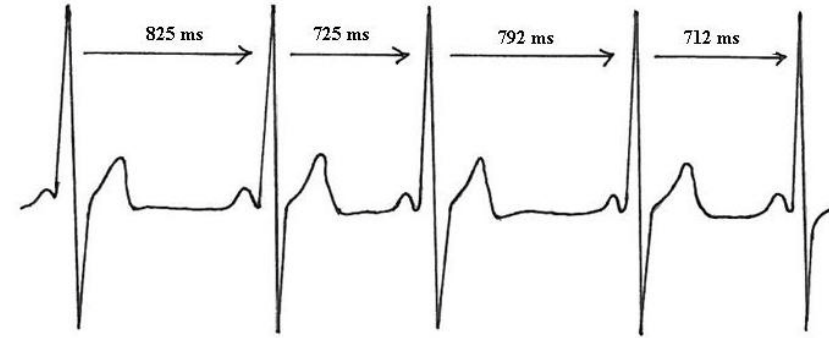




A toolbox to assess stress and pain

Non-invasive techniques used:

- a) Heart rate variability
- c) Infrared thermography
- d) Faecal cortisol metabolites
- e) Hair cortisol



Heart rate variability

- Measured by determining the constantly changing temporal distance between consecutive heartbeats (R–R intervals)
- Reflects the prevailing balance of vagal and sympathetic tone
- Used to assess pain due to laminitis in horses (Rietmann et al., 2004) and disbudding in calves (Stewart et al., 2008)

Heart rate variability

- Can investigate the dynamic functioning of the autonomic nervous system
- Indicator of positive emotional states in animals?
- Animals can be left undisturbed
- Equipment needs to be fitted correctly and secured in place
- Error correction





Infrared Thermography

- The temperature of the lacrimal caruncle and the eyelid, which have rich capillary beds innervated by the sympathetic system, respond to changes in blood flow
- Eye temperature:
Decrease in cattle during painful and fear inducing stimuli (Stewart et al, 2008, Schaefer et al, 2006)

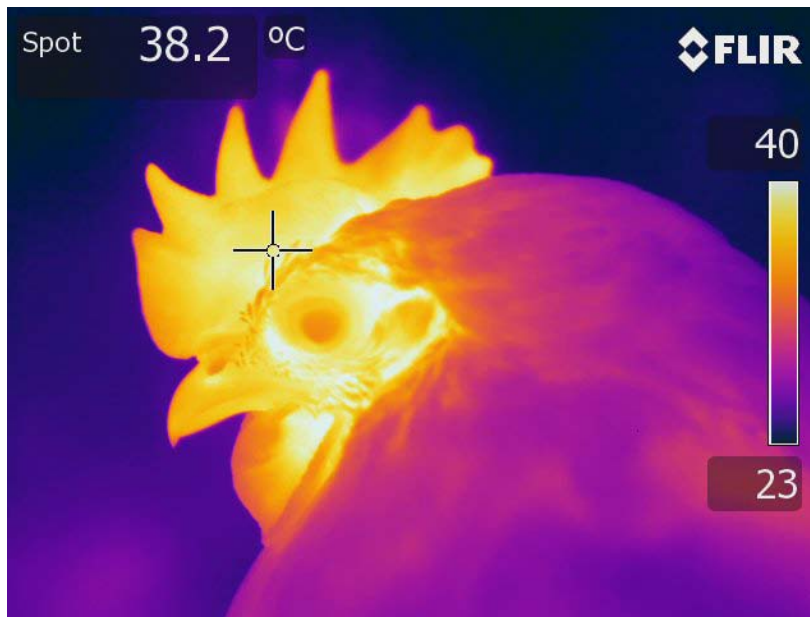


Infrared Thermography

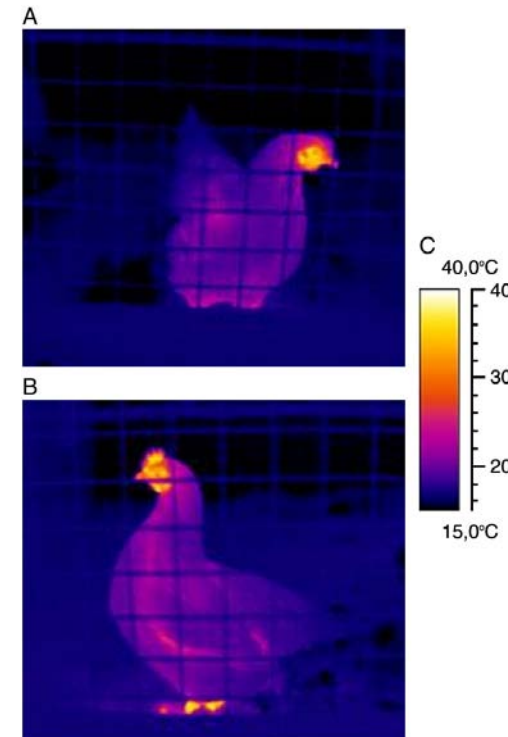
- Docked heifers tended to have greater changes in surface temperatures of tails measured using infrared thermography (IRT) than did nondocked heifers
(Eicher et al.,2005)
- Freeze and hot branding: the sites are warmer than unbranded sites on the same cow -> both methods caused prolonged tissue damage
(Schwartzkopf-Genswein and Stookey 1997)

Infrared Thermography

- A potential physiological indicator of positive emotional states



(Moe et al., 2012)





Infrared Thermography

- IRT equipment is portable, simple to use and animal restraint is minimal or unnecessary
- Must be collected out of direct sunlight and wind drafts
- The effects of weather conditions, circadian rhythms, time following feeding, milking and rumination require further investigation



Faecal cortisol metabolites

- FCMs have been used to assess stress in a variety of species, eg. ruminants (Möstl et al., 2002), rats (Jensen et al. 2010), horses (Schmidt et al., 2010) and in wildlife (Millspaugh and Washburn 2004),
- Minimal disturbance of the animals during sampling
- Ease of collection
- Results remain unaffected by glucocorticoid (GC) secretion in response to handling stress



Faecal cortisol metabolites

- Multiple sources of variation in fecal GC measurement (handling of samples, assay precision, biological effects, interspecies differences in metabolism and excretion)
- The validation of this technique for any given species is crucial for reliable application and the interpretation of results

Hair cortisol

- Hair may accumulate GC hormones over weeks to months
- Increasingly applied to evaluate chronic exposure to various stressors or potentially stressful conditions (Accorsi et al. 2008, Comin et al. 2011, Davenport et al. 2006, Macbeth et al. 2010)



Hair cortisol



- Easy to collect, simple handling of samples, no particular shipping and storage logistics, unaffected by handling stress, enabling retrospective analysis of endogenous cortisol exposure
- Hair follicles found to contain a functional equivalent of the HPA axis (Ito et al., 2005)
- Suggests local production of HC (Keckeis et al., 2012)

On-farm assessment of sheep welfare

- Animal-based measurements
 - eg. body condition score, lameness, cleanliness
- Resource-based measurements
 - eg. temperature, humidity, draft
- Production measures
 - secondary recordings from databases of performance



Photo: Stine Løvik Huse, Animalia



Parameters measured

Animal-based measurements	Resource-based measurements	Data based on production records
Body condition score	Size of pens	Slaughter weight
Animal appears sick/dull	No. and size of animals in pens	Carcass classification
Lameness	Size of trough space	Fat class
Cleanliness	Temperature	
Diarrhoea	Surface temperature of lying area	
Skin lesions	Relative humidity	
Skin irritation	Lighting	
Swollen joints	Draft	
Coughing	Ammonia and CO2	
Eye abnormalities	Solid lying area for lambs	
Nasal discharge	Sharp edges or protrusions	
Udder (inflammation)	Hygiene lying area	
Callus on carpus	Hygiene through space	
Eartag (in place or torn out)	Food (access and subjective assessment of quality)	
Fear		
Human-animal relationship		

Qualitative Behaviour Assessment (QBA)

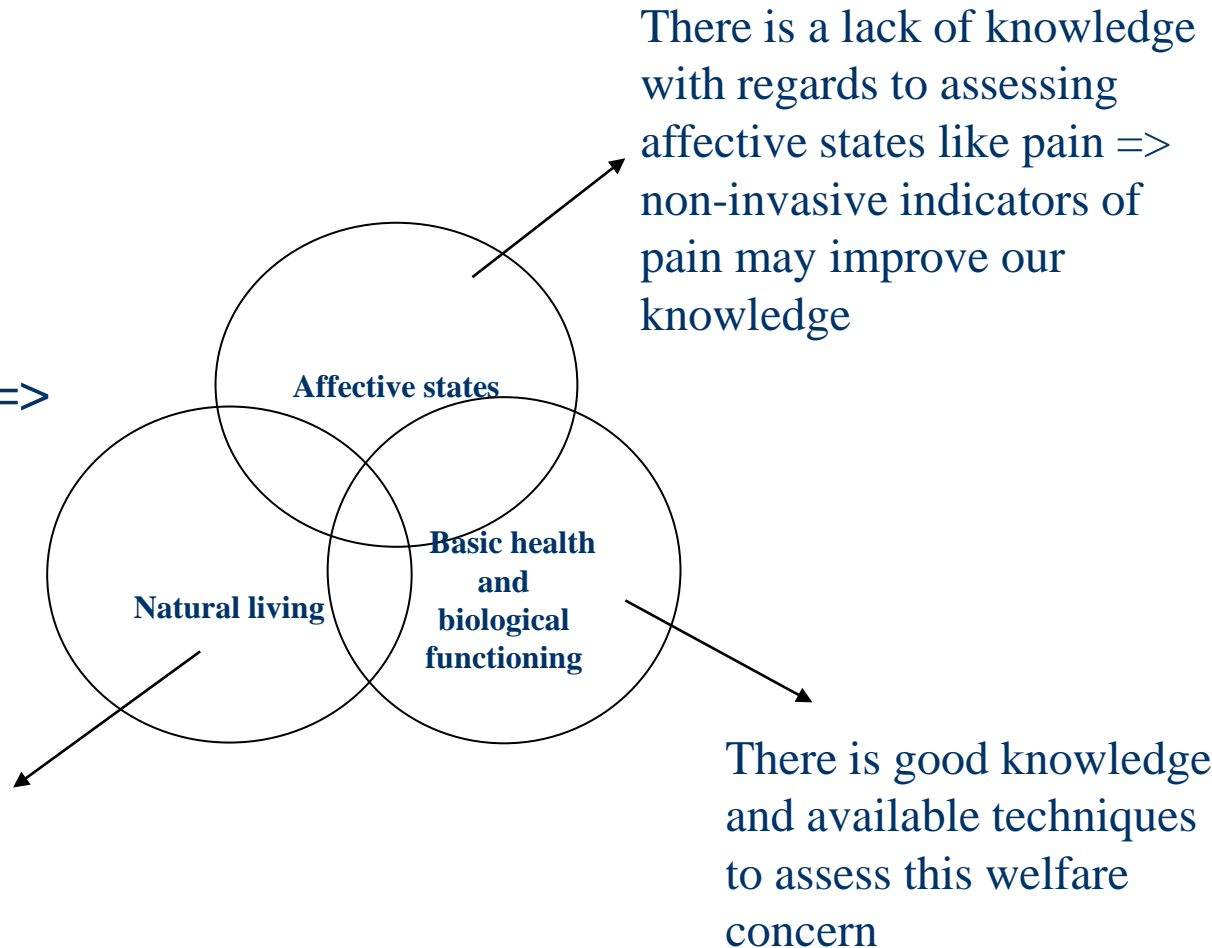


- A ‘whole-animal’ methodology that are used to score an animal’s body language using terms such as content, anxious or relaxed
- This method has shown to be a reliable and feasible indicator for on-farm welfare assessment in pigs (Wemelsfelder et al., 2009), cattle (Rousing and Wemelsfelder, 2006), horses (Napolitano et al., 2008) and sheep (Phytian et al., 2011)
- May be used to assess positive emotions in animals



Animal welfare assessment

Welfare assessment =>





Thank you for your attention



Photo: Grethe Ringdal , Animalia