# Less frequent indicators of poor health and welfare in ruminants

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While studying animal-based measures to be included in the welfare assessment protocols, researchers often identify potential welfare indicators that do not fulfil the standards. This could be due to low prevalence, ambiguous meaning, lack of inter-observer repeatability, or unknown or controversial validity. In this talk we will present some potentially useful welfare indicators that have not been validated and are open to further investigation.

## Stereotypies

Stereotypic behaviours are described as repetitive, topographically invariant response sequences that appear to lack any ultimate or proximal function. This definition of apparent functionless is probably more a result of our ignorance than a true description of the behaviour.[1]

The important question we have to ask when considering using stereotypies in animal welfare assessment protocols is: to what extent does the occurrence of stereotypies reflect emotional suffering? In other words, stereotype behaviours can only be used to assess animal welfare if we understand how they originate and why animals perform them. To do this requires an interdisciplinary approach, using neurophysiological, motivational and cognitive sciences.[1]

Although stereotypies are traditionally viewed as a stress response, associated with frustration, anxiety or fear, it is probably very naive to assume simply that "high stereotypy = bad welfare, and no stereotypy = good welfare".[1]

The most frequent examples of stereotypic behaviours in ruminants are "tongue-playing" (curling and uncurling tongue movements inside and/or outside the mouth), observed mostly in heifers and cows, and biting at fences, walls or troughs, which are common in sheep, goats and calves. Other not so common oral behaviour are repetitive licking of water or of non-food objects, by apparently healthy animals. All these behaviours are almost exclusive of intensive systems and are very seldom observed in grazing animals.

Although it seems clear that oral stereotypic behaviours in ruminants are associated with diet/feeding issues, the exact causes and mechanisms are not known. Therefore its value as a welfare indicator and its health and economic impact, should be discussed.

We have been studying the role of some predisposing factors in tongue-playing in dairy cattle and self-sucking and object biting in dairy goats for the past 10 years. One of the main conclusions is that prevalence varies tremendously across farms, confirming that husbandry plays a crucial role.

Researchers in human medicine have shown evidence that links the development of spontaneous stereotypic behaviours with dysregulation of the basal ganglia.[2] The causes of this dysregulation appear to be a complex interaction of innate predisposition and environmental insult, in particular involving significant acute or chronic stress. We suggest that in some intensively kept and fed ruminants this stress is related to a reduced

need for oral movements – no foraging, no need for chewing and less time ruminating. For example, our studies show that pens where animals (both cattle and goats) are eating a total mixed ration (TMR) with shorter fibre or higher concentrate will show more oral stereotypic behaviours. Also, changes in the prevalence of these behaviours were evident in cattle farms where important changes in feeding were implemented to force a drop in milk production – because the feed trough was empty for a longer time during the day, more animals were seen doing tongue-rolling.

Our studies with dairy goats showed a genetic predisposition for self-sucking (more frequent in more rustic breeds fed with TMR) and that fence and trough biting increased significantly when self-sucking was repressed. Other studies showed that the frequency of self-suckling by goats was reduced when animals were supplemented ad libitum with wheat straw in addition to their ordinary feed.[3]

Other reasons have been proposed to explain why ruminants in intensive systems perform these oral behaviours: in high concentrate/fibre ratio diets the extra saliva produced may help control sub-acute acidosis; stereotypic behaviours results in activation of reward pathways; “extra time” available in the animals’ time budget is occupied with simulation of normal oral behaviour when feed is restricted; the browsing behaviour of goats is not fulfilled.[1]

Apart from the lack of knowledge as to what it means there is another problems in using oral stereotypes in welfare assessment protocols – the low prevalence. If all these animals are kept in the same environment and eating the same diet why do we only see a few animals showing oral stereotypies? Although the answer is not certain there may be individual factors relating to proactivity that mediate whether an animal expresses stereotypic behaviour or copes with the situation by other (less evident) ways. For example, it has been suggested that the alternative strategy may be depression and emotional blunting – also indicators of poor welfare, but much harder to measure.

Another abnormal oral behaviour is cross-sucking and inter-sucking in cattle dairy farms. Especially in farms adopting a cross-breeding programme, we have seen a huge increase in this behaviour that is responsible for very important health and welfare problems – mastitis, dry quarters, early culling… Once more, we do not know what are the causes behind the psychological need to perform this behaviour but several theories have been proposed – hunger; reduced time sucking (high milk-flow…); frustration for not sucking at all (e.g. bucket feeding); social stress…

In a farm where cross-sucking is very prevalent we filmed the behaviour of dairy calves for three full days analysing the social behaviour and its correlation with the establishment of cross-sucking. We followed the female calves up to 6 months old. Only 18 % of the calves did not perform cross-sucking, although not all continued to perform inter-sucking. It was demonstrated that genotypic predisposition should be considered. For example, we showed that Montbéliard-Holstein cross calves will adopt cross-sucking behaviour much more frequently than other breeds. Through the use of Social Network Analysis[4] we found that there are “popular” calves that are sucked by many in the group and that there are calves that only suck on each other. We also found that dummy teats are not useful in controlling the cross-sucking behaviour and that cross-sucking does not occur more when feeding is interrupted or milk quantity is rationed.

In conclusion, we suggest that oral stereotypic behaviour occurs because some quality or quantity feeding needs are not fulfilled. Thus it is a sign of relevant welfare problems, although the low prevalence may preclude its use in routine welfare assessment

protocols. All these behaviours deserve further research as the welfare and health significance seem to be important.

**Qualitive Behaviour Assessment (QBA)**

It is assumed that welfare is associated with negative emotions such as fear, distress, frustration or apathy but also with positive emotions such as security or contentment. It is consensual that good welfare is more than the absence of negative experiences, residing primarily on the presence of positive experiences, such as pleasure. Contemporary animal welfare thinking is increasingly emphasising the promotion of positive states.[5] However, there is still no agreement on how to assess these positive experiences.

Qualitative Behaviour Assessment (QBA) is an animal based indicator that assesses the expressive qualities of animal demeanour by describing a group of animals through adjectives such as 'relaxed', 'anxious' or 'curious. So the qualitative assessment of behaviour integrates and summarizes the several aspects of an animal's dynamic interaction with its surroundings.

QBA application requires knowledge of animal health and production, and species-typical behaviour. If we reflect on this we can remember many examples of experienced farmers or vets performing QBA. Everyone has already heard a farmer saying that the herd is nervous or suspecting that something went wrong during the night when they approach a flock. Usually they are right. So it seems that validation is possible. But is it a reliable, repeatable and feasible indicator?

Different research teams have applied this approach with several species such as pigs, cattle, poultry, sheep, buffaloes and horses and have found good agreement between observers' assessments, even when these observers had different backgrounds and levels of experience.[6]

QBA was used in dairy goat farms in Portugal and Italy (and in sheep farms in Spain and Scotland), as part of the AWIN protocols. Assessors were veterinarians and animals scientists with different experience, but all subject to the same previous training. Goats were observed from outside each pen and assessment took place during the activity periods of goats, where different behavioural expression might be exhibited. Only at the end of the observation period, would the assessor rate a list of 13 descriptors (e.g. 'calm', 'alert', 'curious, 'relaxed') using a visual analogue scale (VAS) according to the overall general behaviour of the pen. Principal Component Analysis (covariance matrix, no rotation) was used to analyse each assessor's scores. PCA analysis revealed two dimensions of goat behaviour labelled positive/negative mood (PC1) and high/low arousal (PC2). PC1 of the QBA, which carries most of the relevant variance, allowed for the differentiation between farms with animals that appeared to be in a more positive mood from farms that presented animals with a more negative mood. According to Wemelsfelder and Lawrence (2001), descriptors such as agitated, lively and alert reflect the animals' experience of a situation being directly relevant to the assessment of their welfare.[7] The homogenous overall distribution of farms throughout the two axes supports the notion that housing and management have a real effect on the animals' on-going behaviour. In fact, these farms were only selected based on their herd size, and all the animals were bred under an intensive production system. With regard to QBA's inter-observer reliability analysis, we found a low level of observer agreement on the second dimension (PC2) that is most likely a result of the lack of intensive training because the

descriptors (bored, content, curious, irritated, relaxed or sociable) were not as evident as the ones used in PC1. Our results suggest that training is a crucial requisite for applying QBA and that it should include the discussion of the meaning of each QBA descriptor so as to standardize the evaluations.

The AWIN protocol for sheep and other studies have used QBA as a welfare assessment tool. The results support QBA as being an indicator with large potential but needing further exploration of the feasibility and validity of some descriptors.

**Facial expression**

Ruminants, and especially sheep, are stoical species and for this reason pain associated with disease is often overlooked, resulting in poor animal welfare.

Evidence of pain that is available from facial expression and subsequent scoring systems, have been the subject of considerable scientific investigation in humans, rodents, rabbits and horses. It is well known that skilled stockmen and experienced veterinarians can also identify pain by the facial expression of their animals.

The Cambridge team from the AWIN project developed a standardised facial expression pain scale for adult sheep, that can be used reliably and accurately to detect pain associated with naturally occurring painful diseases, such as footrot and mastitis. The facial expression pain scale showed good relationships with lameness and lesion scores of footrot in sheep with good intra- and inter- observer reliability. Facial expression pain scale may be used to train animal keepers and veterinarians to recognise pain in sheep and horses, thus facilitating better pain management and improved animal welfare.

The procedure in Cambridge involved visiting eleven commercial farms when disease was reported, and evaluating the changes in clinical condition and facial expressions across recovery time. Of 111 sheep over one year of age, 73 were identified as having footrot by a veterinarian through lameness and lesion scoring. These sheep were matched with 38 control sheep identified as having no sign of footrot or other disease. All sheep were assessed for lameness using the five point gait scoring method. Photographic images of sheep faces were taken on the day of disease identification after lameness and lesions were scored. All sheep were treated on the same day after images had been collected with antibiotic (tulathromycin subcutanerous and topical chlortetracycline) and with the non-steroidal anti-inflammatory meloxicam (subcutaneous). All sheep were revisited during their recovery period and facial images were recorded on day 90. Animals were reassessed for lesions and lameness to establish that they were fully recovered. A study of 17 sheep with mastitis and 12 control sheep was conducted in the same way but without topical antibiotic use. The sheep pain facial expression scale involved scoring five facial areas; orbital tightness, cheek tightness, ear position, lip and jaw profile, and nostril and philtrum position. These areas are scored as abnormal expression present (2), partially present (1), or not present (0). A total pain score of 1-10 was determined by adding the individual scores for each of the five areas for each set of photographs. On the first day, the total pain score was higher in the sheep with footrot than in controls ($p = 0.0005$) but at 90 days after treatment there was no difference. Sheep with mastitis also had a higher total pain score than controls. Trained observers scored faces similarly.[8]

Another two teams used facial expressions as indicator of pain in other species. In Portugal, studies of pain after disbudding and in goats with pregnancy toxaemia, gave similar results – it was possible to recognize animals in pain by scoring photographs of the head. In Germany the same type of scale was used to evaluate pain for the first 48 hours after surgical castration under general anaesthesia. Forty stallions were divided into groups receiving a single injection of Flunixin immediately before anaesthesia or Flunixin immediately before anaesthesia and then again, as an oral administration, six hours after the surgery. In addition, six horses were used as anaesthesia controls (C). in

animals treated with one or more doses of an analgesic. It was concluded that the Horse Grimace Scale potentially offers an effective and reliable method of assessing pain following routine castration in horses. This work lead to the development of a Horse Grimace Scale Smartphone Application (HGS App; available at https://play.google.com/store/apps/details?id=info.awinhub.HorseGrimacePainScale&hl=en), to teach users to recognize and then assess pain in horses using facial expressions.

Recognizing face expressions is a tool that is likely to improve farmers' ability to quantify pain in animals and allow observers to discriminate between different pain states independent of disease status, as well as detect the effectiveness of pain relief. Prompt recognition of pain through the use of these scoring scales will enable farmers and veterinarians to treat and manage their animals better, reducing the impact of pain and improving welfare and production. However, even if facial expression is validated as an indicator of pain, it is still hard to conceive it being useful as a tool in a more general setting of welfare assessment.

**Passive behaviours**

Pain related behaviours such as head shaking, stargazing, lipcurling, trembling, abnormal postures, scratching against objects and vocalisations have all been well documented when assessing pain in calves and lambs undergoing tail docking, disbudding and castration.

All these are active behaviours and relatively well recognized signs of pain. However we have found that passive behaviours – lethargy, apathy or obliviousness – may also be important.

Apathy, where an animal is abnormally passive and does not react to stimuli, is traditionally associated to social isolation or barren environment. However the results of a study on the behaviour after caustic-paste disbudding in calves showed that ''inert lying'' is an important behaviour that should be used to assess pain in young animals.[9] Apathy was never seen in our studies with animals scoop or hot-iron dehorned, and this may be related to the type of pain (chemical versus mechanical or thermal) or the calves' age (younger in paste dehorning). Interesting is the fact that calves showing inert behaviour had a plasma cortisol peak just before.

Overlooking this passive behaviour is usual in farms because people expect that animals react violently to pain. As a result of this misconception, many animals suffer because no pain management is implemented. Neglecting the significance of inert lying may also lead to erroneous conclusions when evaluating the intensity and duration of distress in young calves, as active behaviours will be more uncommon in an ethogram.

**Rib lesions**

During clinical examination of dairy cows it is not infrequent to find hard bony enlargement on some ribs. Although these are not usually painful it is important to evaluate its' clinical and welfare significance. If these are chronic stages of painful rib lesions, there may be welfare and economic implications, which makes it urgent to understand how they affect animals and what can be done to avoid them.

We conducted a study to determine the prevalence of these costal lesions in dairy cows kept in intensive system and to identify the risk factors either associated with the farm or with the animal. We examined 1319 dairy cows from 22 dairy farms. In each farm stalls were measured, and bedding and flooring were classified. Additionally we measured, performed a superficial clinical examination, including lameness scoring, and registered the clinical history of each animal showing any rib lesion.

The global rib lesions' prevalence was 2.3%. Statistical analysis showed that the main farm risk factors for rib lesions are: small cubicles, insufficient feeding area and presence

of stalls with unprotected posterior edge. Rib lesions were associated also to some animal characteristics: 82% had a history of chronic lameness and an average of 3.70 lactations. At the time of the study 52% of the animals with rib lesions also showed lameness signs.

It is concluded that many less known and evident indicators can be used to assess welfare in farm animals, but research to validate them is still needed.

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