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On-farm qualitative behaviour assessment in sheep: Repeated measurements across time, and association with physical indicators of flock health and welfare

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ABSTRACT

Qualitative Behavioural Assessment (QBA) is a 'whole-animal' methodology that assesses the expressive qualities of animal behaviour using terms such as 'tense', 'relaxed', 'anxious', and 'content'. The reliability and validity of QBA as an indicator for on-farm welfare assessment in pigs, cattle, poultry and sheep has been examined in a number of ways. However, the use of QBA on farms over longer periods of time has not yet been examined. The aim of this study was to investigate whether and how on-farm QBA of sheep varies over the different seasons of the year, and whether it is associated with physical measures of sheep health and welfare such as lameness. A trained assessor visited each of 12 farms six times within a one year period at two month intervals, and made group level assessments of approximately 100 sheep selected ad hoc (assuming homogeneity within the flock). The sheep flocks were assessed with a list of twelve QBA descriptive terms previously developed for sheep. Following QBA, the same sheep were also assessed with seven physical indicators of health and welfare ('dull physical demeanour', lameness, breech and abdominal soiling, pruritis, wool loss, and coughing). QBA scores from all visits were analysed together, and also in combination with the physical measures, with Principal Component Analysis (PCA – correlation matrix, no rotation). The effect of visit on PCA flock scores was analysed with random-effects multiple linear regression models. The association between PCA flock scores and physical measures was investigated using Spearman rank correlation (rS), and the correlation of flock rankings across visits was examined with Kendall Coefficient of Concordance. PCA distinguished two main dimensions of sheep expression: PC1 (47% variation) ranging from content/relaxed/thriving to distressed/dull/dejected (summarised as 'mood') and PC2 (21%), which ranged from anxious/agitated/responsive to relaxed/dejected/dull (summarised as 'responsiveness'). No significant effect of visit on PC1 scores was found ($p = 0.155$), and PC1 flock scores correlated at $W = 0.84$ ($p < 0.001$) across the 6 visits, indicating high consistency of characterisations of individual flock mood over the year. However there was an effect of visit on PC2 scores ($p < 0.001$), and PC2 flock scores were correlated at $W = 0.60$ ($p < 0.001$) across visits, indicating that the presence of young lambs may have had a consistently relaxing effect on flocks. There was also an effect of visit period on lameness ($p = 0.025$), and on breech ($p < 0.001$) and abdominal ($p = 0.0048$) soiling. With the exception of lameness and breech and abdominal soiling, the physical indicators were observed at a low prevalence (<2%) across the study farms. The highest lameness levels were observed during the winter period (mean 17.86%, 95% CI 7.83–27.90) whilst breech soiling was highest in spring (mean 23.83%, 95% CI 11.86–35.81). An effect of farm type was found on lameness scores ($p = 0.0176$) and an effect of flock size on abdominal soiling scores ($p = 0.025$). PC1 'mood' scores were negatively correlated to the proportion of lame sheep ($n = 72$; $rS = -0.72$, $p < 0.001$), and to the proportion of animals with dull physical demeanour ($rS = -0.70$, $p < 0.001$), while PC2 'responsiveness' scores showed a weak correlation with breech soiling ($rS = 0.42$, $p < 0.001$). In summary, these results suggest that QBA has the potential to serve as a sensitive, meaningful indicator for on-farm welfare assessment in sheep.

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1. Introduction

Qualitative Behavioural Assessment (QBA) is a 'whole-animal' methodology that assesses the expressive qualities of animal behaviour using terms such as 'tense', 'relaxed', 'anxious', and 'content'. Thus it addresses an animal's 'body language', including both negative and positive aspects of well-being, and has the potential to integrate and help interpret specific clinical measures of physical and psychological health (Napolitano et al., 2009; Wemelsfelder and Lawrence, 2001; Wiseman-Orr et al., 2006). This methodology has been applied to assess animals on-farm and during transport both individually and at group-level, with different livestock species such as pigs, cattle, poultry and sheep (e.g. Bassler et al., 2013; Rousing and Wemelsfelder, 2006; Stockman et al., 2011; Temple et al., 2011; Wickham et al., 2012). Generally good levels of inter-observer reliability (but not always, see Bokkers et al., 2012), meaningful associations with other measures (but not always, see Andreasen et al., 2013), as well as short assessment times, suggest this method has the potential to be an effective welfare indicator that can be readily applied in the field.

In common with other global pasture-based production systems, sheep managed under British farming systems spend a considerable part of the production cycle outdoors at pasture being kept in specific management groups. Therefore, groups of sheep often require gathering and handling to facilitate close inspection and assessment of the health and welfare of both the individual sheep and the flock. Since disturbance by humans, dogs and handling can alter ovine behavioural expression (Boivin et al., 2000; Le Neindre et al., 1996) and mask painful conditions (Fitzpatrick et al., 2006), it is possible that some sheep with welfare issues may be missed when gathered for closer examination. Furthermore, the practicalities of assessment need to be considered for different management systems. The gathering and handling of extensively-managed sheep and those managed over multiple locations can be time and labour consuming and also may not be appropriate at certain periods of the production calendar, for example, when ewes have young lambs at foot or during the mating period. Therefore, a welfare indicator that does not involve major disturbance, requires few resources, and offers valid information on the health and wellbeing of groups of animals, could offer clear benefits for sheep, producers and assessors.

One major concern in the development of on-farm welfare assessment protocols is the challenge of interpreting fluctuations shown by welfare indicators across time. Such fluctuations may be part of normal day-to-day or seasonal variations in welfare, may reflect more serious deviations of basic welfare, or could reflect the effects of varying times and contexts on repeat assessments. Thus, if repeated assessments of the same farm do not show similar levels of animal demeanour, it is difficult to know whether this difference reflects normal baseline variation, a welfare problem, or a problem of intra-observer reliability (Temple et al., 2013). The aim of this study was to apply QBA to the repeated assessment of sheep at flock level in a one-year longitudinal study, to investigate whether and how the sheep's expressive demeanour would be perceived by an experienced assessor to vary across 6 visits at two-monthly intervals. To evaluate these assessments against other welfare indicators, seven physical measures of sheep health and welfare were also examined.

2. Materials and methods

2.1. Design of longitudinal study

A longitudinal on-farm study performed during the period of May 2009–April 2010 was conducted on twelve farms, located in North-West England and North Wales, which had previously participated in a sheep welfare research project. Farms were selected according to their location, farm type and owner's informed consent to participate. Selection provided a sample of eleven commercial flocks and one small-holding, including farms from hill, upland and lowland areas (for details see Table 1). At each visit, each farm was asked to provide a sample of 70–100 sheep that were selected ad hoc by the farmer and left undisturbed for assessment. This sample size was not related to a farm's flock size, but was based on previous experience of the assessor regarding the feasibility of completing the protocol of qualitative and quantitative assessments within the time limits of a day visit. The exact numbers of sheep selected at each farm for each visit were recorded. The study was approved by the University of Liverpool Ethics Committee (ethical review reference number RETH000287).

Table 1
Overview of assessment visit periods.

Visit	Study period	Season	Production stage
1	May–June 2009	Spring/Summer	Post-lambing
2	July–August 2009	Summer	Weaning
3	September–October 2009	Autumn	Mating
4	November–December 2009	Autumn/Winter	Early pregnancy
5	January–February 2010	Winter	Mid-pregnancy
6	March–April 2010	Spring	Lambing

During the one year study, flocks were repeatedly assessed by one sheep veterinary surgeon who performed all QBA and physical indicator assessments on all farms throughout the study. Repeated sampling of twelve sheep flocks over 6 visits spread out over one year produced 72 on-farm assessments. Flocks were visited at an interval of approximately 60 days, to coincide with key periods in the sheep production cycle (Table 2). At each visit, the selected group of sheep was firstly assessed using twelve QBA descriptors (relaxed, dejected, thriving, agitated, responsive, dull, content, anxious, bright, tense, vigorous and distressed), which had previously been developed and tested for inter-observer reliability by Phythian et al. (2013a). Due to their integrative, qualitative nature, it is impossible to define QBA terms in precise physical terms such as is done for conventional ethograms (however very recently QBA studies have begun to provide brief qualitative characterisations of individual terms to enhance observer agreement). Detailed instructions for how to score QBA terms were developed for the Welfare Quality® protocols for cattle, pigs and poultry (Welfare Quality®, 2009), including careful reflection on, and, where more than one assessor are involved, discussion of, the meaning of individual terms. These instructions were followed in the present study.

The assessor quietly approached the sample group and performed assessments from a distance by standing at the boundary of a field, or several metres from groups of housed animals. The exact sizes of fields and assessment areas were not measured, but a number of observation points was selected according to the relative size of the field and sample group, after which a 5 min period was allowed to let sheep get accustomed to the presence of the assessor. The mean number of sheep assessed in any one group was 77, and ranged from a minimum group size of 24, which represented all the flock of a small-holding farm, to a maximum group size of 137 animals on a commercial farm. Minimal disturbances of the sheep by assessor movements, particularly in situations where scrutiny of individual animals was difficult, were found to be helpful and considered acceptable. The observer then spent 5 min at each of the observation points, visually scanning the designated observation area to assess the entire sample group of sheep. When observations were completed, the groups' predominant behavioural expressions were scored on each of the QBA terms along a visual analogue scale (VAS) of 125 mm length, labelled from 'zero' to 'maximum'