Applied Animal Behaviour Science 180 (2016) 51–57

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

On-farm Qualitative Behaviour Assessment of dairy goats in different housing conditions

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ARTICLE INFO

Article history:
Received 21 January 2016
Received in revised form 13 April 2016
Accepted 17 April 2016
Available online 29 April 2016

Keywords:
Qualitative Behaviour Assessment
Dairy goat
Inter-observer reliability
Indoor housing
Pasture
Animal welfare

ABSTRACT

This study reports the results of the first investigation on the use of Qualitative Behaviour Assessment (QBA) in dairy goats, using a fixed-list of descriptors specifically developed for this species. It aimed to verify whether QBA can be reliably used by observers with different backgrounds to differentiate between the emotional states of goats kept under different environmental conditions. Two trained observers simultaneously assessed 16 dairy goat farms (8 "Housed" (H) farms, where animals were observed in free stall pens, and 8 "Pasture" (P) farms, where animals were observed in open ranges), using a list of 16 QBA descriptors that were based on literature studies and discussed within a focus group of goat experts. One H farm was removed from analysis due to procedural error. The QBA scores were analysed together using Principal Component Analysis (PCA, correlation matrix, no rotation). Observer agreement for farm scores on PCA Components (PCs) and on separate QBA terms was investigated using Pearson and Spearman correlations respectively. The effects of housing system and observer on PC scores were analysed using analysis of variance (treatments = observer, housing system, and their interaction; block = farm). PCA identified three main components explaining 60.87% of the total variation between goat farms: PC1 (29.04%) ranged from "content/calm" to "frustrated/aggressive", suggesting a relationship to the animals' general mood; PC2 (19.70%) ranged from "curious/attentive" to "calm/bored", suggesting a relationship to the animals' level of arousal, and PC3 (12.13%) ranged from "sociable/playful" to "alert/agitated". The two observers showed a good level of agreement on the three PCA dimensions (PC1: $r = 0.75$, $P = 0.001$; PC2: $r = 0.67$, $P = 0.006$; PC3: $r = 0.69$, $P = 0.004$), and also on 7 out of 16 separate QBA descriptors ($P < 0.05$). Two additional descriptors showed a moderate level of agreement ($P = 0.10$). These results indicate an integrated PCA approach to QBA to be more robust. There were significant effects of housing system on both PC1 (ANOVA; $P = 0.05$) and PC2 ($P = 0.02$), indicating goats on P farms to be more "content/calm" and "curious/attentive" than goats on H farms. There was a significant observer effect on PC2 ($P = 0.04$), and a significant observer by housing interaction on PC3 ($P = 0.009$). In sum, these results suggest that QBA can be a reliable welfare indicator, used by observers with different backgrounds; however, further development of QBA training procedures is required to extend inter-observer reliability to all main expressive dimensions emerging from the analysis.

1. Introduction

During the last decade, the assessment of animal welfare at farm level has received increasing attention, in response to consumer demand for assurance schemes of high quality animal products, including animal welfare. Most of the indicators developed for welfare assessment have been focused on negative aspects, and a need to develop more positive welfare indicators has been identified by several recent reviews (Boissy et al., 2007; Yeates and Main, 2008). Particularly the inclusion of positive qualitative indicators may play a key role in the communication of animal welfare to stakeholders, and therefore deserves further attention (FAWC, 2009). In a recent review on animal-based welfare indicators for dairy goats, Battini et al. (2014) identified Qualitative Behaviour Assessment (QBA) as a promising approach to evaluate positive emotional state in this species.

QBA is a "whole-animal" method for evaluating the expressive quality of animal behaviour, using qualitative descriptors such as

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http://dx.doi.org/10.1016/j.applanim.2016.04.013
0168-1591/

"tense", "content", or "relaxed" (Wemelsfelder et al., 2000, 2001; Wemelsfelder, 2007). Such descriptors have an emotional connotation, and can give information that is directly relevant to animal welfare, and complements the information provided by quantitative welfare indicators (Wemelsfelder et al., 2001). QBA offers advantages in terms of on-farm feasibility, in that it does not require any restraint or intervention in the lives of animals, can be applied at herd-level, and, once on farm, is not time-costly or labour-intensive. The inter-observer reliability and biological validity of QBA applied under controlled experimental conditions have been well-documented for a range of species (e.g. Stockman et al., 2011; Rutherford et al., 2012; Wemelsfelder and Mullan, 2014); however, the on-farm use of pre-fixed QBA term lists, such as during on-farm animal welfare inspections, requires further development and validation.

Good on-farm observer agreement has been reported for laying hens (Wemelsfelder et al., 2009), beef cattle (Wemelsfelder et al., 2009; Wemelsfelder and Millard, 2009), dairy cattle (Andreasen et al., 2013), dairy buffalo (De Rosa et al., 2015), and donkeys (Minero et al., 2016). Studies of on-farm video footage showed good observer agreement for sheep (Phythian et al., 2013), but not for dairy cattle (Bokkers et al., 2012; Gutmann et al., 2015). Few studies as yet have correlated on-farm QBA assessments to other measures taken on farm. Andreasen et al. (2013) did not find QBA assessments of Danish dairy farms to correlate to any outcomes of the Welfare Quality® protocol applied on the same farms a few days later, however Phythian et al. (2016) did find a good correlation between QBA assessments made on UK sheep farms and the proportion of lame sheep on these same farms as determined at a later point in time. On-farm QBA of sheep flocks on a range of farm types was found to be highly consistent across 6 visits in a year (Phythian et al., 2016); however, a video study by Gutmann et al. (2015) found the general mood of dairy cattle to vary significantly across different times of day, raising concerns about the need to standardise on-farm assessment times.

There is thus a need for further studies on the use of QBA in on-farm welfare assessment: the present study focuses on QBA assessment of dairy goats in different housing conditions, and tests the inter-observer agreement between two assessors with different professional background and experience. To date, only Muri et al. (2013) have reported a first attempt to apply QBA to goats: QBA was included in a comprehensive welfare assessment protocol for intensively farmed dairy goats. It was applied at group level and consisted of five descriptors (resting, aggressive, inquisitive/interested, fearful, calm/indifferent), which were modified from the terms used in the Welfare Quality® Protocol for dairy cows. This study was encouraging in that it found some significant correlations between QBA descriptors and health indicators and stockmanship. However, the Muri study used a limited number of descriptors, which did not adequately cover the expressive repertoire of goats. The goal of the current study was to apply QBA to goats in either pasture of housed management systems, and test its reliability for use by assessors from differing backgrounds.

2. Materials and methods

2.1. Experimental design

2.1.1. Development of QBA fixed list descriptors for dairy goats

A pre-fixed list of descriptors was used for this study, as this approach is considered more feasible for applying QBA to practical on-farm welfare assessment than the original Free-Choice Profiling approach, in which each observer generates his/her own descriptors (Wemelsfelder et al., 2009). The existing scientific literature on goat behaviour and welfare was reviewed in order to identify a list of potential QBA descriptors for dairy goats. A list of 32 descriptors was produced and then discussed in April 2013 by a panel of 10 Italian goat experts (farmers, veterinarians, technicians and researchers). This panel removed 20 descriptors from the list, either because they were considered too prone to anthropomorphism (e.g. angry), too generic (e.g. active), or too similar to other terms (e.g., explorative-curious, agitated-nervous, calm-relaxed). Furthermore, the term "interested" was replaced by "attentive", and two new terms (bored, irritated) were added. Once the Italian goat experts had reached agreement on the use and definition of 15 descriptors, the discussion was extended to international level, involving nine goat experts engaged in the European Animal Welfare Indicators (AWIN) project, who added one new attribute (suffering).

The final list of descriptors thus included 16 fixed terms: aggressive, agitated, alert, bored, apathetic, attentive, content, curious, frustrated, playful, irritated, fearful, sociable, suffering, calm, and lively. For each descriptor a brief definition was provided in order to facilitate its interpretation by different observers (Table 1).

2.1.2. Farms and animals

QBA was applied on 16 Italian commercial dairy goat farms. In all farms, animals were housed in pens with straw litter, while in 8 farms goats had free access to pasture from spring to autumn. These 8 farms ("Pasture", P) were assessed outdoors, at pasture, whereas the other 8 farms ("Housed", H) were assessed indoors. All farms were visited in May 2013. Observations were performed on all lactating animals. Only farms with more than 30 female adult goats were selected (mean 91.0 ± 80.7, min 38, max 370 lactating goats). Before farm visits, the farmers were contacted and received basic information about the research.

2.1.3. Observers

Two independent observers conducted the QBA observations on-farm. Observer A (Obs-A) was a female veterinarian with work experience in extensive and organic goat practices. Observer B (Obs-B) was a female post-doctoral animal scientist, specialized in farm animal welfare, and familiar with intensive dairy goat farms. Neither of these observers had previous experience with QBA. Furthermore neither observer was familiar with any of the 16 selected farms, and so their judgment could not be biased by any previously conceived views regarding a specific farm.

Before starting the on-farm data collection, both observers received training in applying QBA to goats at group level. To practice, they both scored 15 video clips of two minutes each, showing groups of goats in different situations, using the 16 descriptors. After watching and scoring each video, the assessors compared their scores for the different terms, and discussed any discrepancies. They would then each watch and score the videos again, and repeat this process, until agreement on the interpretation and quantification of each descriptor was reached.

2.1.4. Data collection

On farm, the QBA assessment was performed by direct observation carried out during an activity period of the goats. In H farms, goats were observed in their home pen 60 min after feed distribution; whereas in P farms goats were observed in open pasture. All observations were performed 60 min before or after milking procedures. The two observers assessed the goats independently and simultaneously, without interfering with each other or the animals. The assessment was always performed on the whole herd and not on individual animals.

The QBA on-farm assessment procedures followed those developed for the Welfare Quality® protocol (Welfare Quality®, 2009). Observation of animals was carried out from one or more locations around the pen or grazing area (observation points) from which