

Potential animal-centred indicators of dairy goat welfare

M Mazurek, M Marie* and D Desor

Nancy-Université, URAFPA, ENSAIA, BP 172, 54505, Vandœuvre lès Nancy, France

* Contact for correspondence and requests for reprints: Michel.Marie@ensaia.inpl-nancy.fr

Abstract

This paper presents five tests based on behavioural and other animal-centred observations concerning dairy goat welfare. An emotional reactivity test ($n = 40$) classified the animals into different groups according to their behaviour in response to fear-eliciting stimuli, and identified anxious animals. Movement parameters and behaviour, as well as quantitative (number of cries) and qualitative (pitch, intensity, length) sound parameters were recorded. A dominance test ($n = 35$) based on antagonistic reactions resulted in three hierarchical groups (subordinate, $n = 9$; intermediate, $n = 6$; and dominant, $n = 20$). A test performed in the milking parlour ($n = 108$) showed that the order of passage was strongly preserved and linked to limb pathology and dominance index. Finally, a lameness test (12.5% were lame) and a standing up test (8.5% had problems getting up) showed that these two parameters were highly correlated. After some simplifications, these tests could form a goat welfare evaluation method.

Keywords: animal welfare, behaviour, dominance, fear, goat, indicators

Introduction

Intensive breeding of dairy goats, associated for example with the stockman spending less time with the flock, high stocking density, confinement, or equipment which can be fear eliciting or harmful to animals, may result in poor animal welfare. Among the different methods available for assessing animal welfare (Broom 1991), only a few focus on the direct observation of the animals themselves (Johnsen *et al* 2001). Moreover, the animal-centred methods do not target small ruminants (Blockhuis *et al* 2005).

The aim of this study was to examine behavioural parameters which could be used to assess dairy goat welfare, or which could help to formulate welfare standards. It complements previous studies based on environmental parameters (El Balaa & Marie 2004, 2006).

Materials and methods

Emotional reactivity

Forty goats were tested individually in a 4×3 m (length \times breadth) pen isolated from the rest of the flock. They were left alone for 5 minutes (phase 1) and then four different stimuli were presented for 3 minutes each in this order: 2) a white and red cone, 3) a non-familiar person, 4) the same person moving through the pen and, 5) an immobile dog. They were then, (phase 6) left alone for three more minutes. A small amount of food was placed near the stimulus. The data collected was: movements, number, intensity, pitch and length of cries, micturitions and defaecation, the number of times the animal put its legs on the

pen barrier or sniffed at the stimulus, the number of glances towards the stimulus, whether the goat fed near the stimulus and stayed near or far from the immobile, non-familiar person and whether it was indifferent or frightened when the person was moving.

Hierarchical structure

Thirty five of the 40 goats were put together in a test pen and observed three times for two hours. The pen lacked 5 feeding places in order to increase the competition between animals. The data collected was: the number of antagonistic reactions initiated and received per animal and their nature (displacing, supplanting, frightening or assaulting), and the number of fights.

Behaviour during milking

The entire flock of dairy goats ($n = 108$) was observed twice in the milking parlour. We recorded hesitations or refusals when going to and leaving the milking parlour, as well as the time taken to move through the ramp. The order of passage was also recorded. When the animals were in the parlour, limbs and udders were examined in order to detect health problems and symptoms such as those of the caprine arthritis encephalitis virus or of mastitis.

Lameness and standing up

Gait was observed in the 40 goats selected for the emotional reactivity test and a lameness score was assigned as follows: 1) normal gait, 2) the animal swings its hips when walking, 3) abnormal gait, and, 4) inability to bear weight on one or more of its limbs). Thirty five received a standing up score:

1) sequence identical to the reference sequence, 2) the goat stops for a moment during the sequence and, 3) the goat lifts its back first.

Statistical analyses

Principal component analysis (PCA) and cluster identification by hierarchical classification were performed using the SPAD v 5.5 software (Decisia, France). Mean comparisons for repeated measures were performed by Residual Maximum Likelihood (REML) procedure using Genstat v 8.1 (VSN, UK).

Results

Emotional reactivity

Most animals calmed down during the test, reducing their movements, their cries and their attempts to leave the pen between phase 1 and 6 (Figure 1). Movements, cries and escape attempts decreased during phases 3 and 5, while movements and glances toward the moving non-familiar person (phase 4) increased. The animal bleat pitch decreased significantly with the immobile person and the dog, and the length of their cries also decreased in phases 3, 4 and 5 (Figure 2).

In order to identify a typology of behaviours in response to fear-eliciting stimuli, a multivariate analysis (PCA) was performed using the principal axes resulting from primary PCAs carried out on phases 1 + 6, 3, 4, and 2 + 5 with the variables measured during the reactivity test. We identified 3 groups. Group 2 was composed of the least anxious animals. They exhibited reduced movements, cries and excretions. They spent more time near the stimuli and ate more than the animals in the other groups. Animals in groups 1 and 3 were more anxious. They exhibited increased movements and excretions, spent less time near the stimuli and ate less than the animals of group 2. In group 1, animals cried more than in the other groups. Animals in group 1 excreted more during phase 3, whereas animals in group 3 did so during phase 4.

Hierarchical structure

A dominance index was calculated as follows: index = number of interactions initiated/number of total interactions. Three groups of animals were identified: subordinate (index: 0-40%, $n = 9$), intermediate (index: 41-70%, $n = 6$), and dominant (index: 71-100%, $n = 20$). Older goats dominated more than young ones (index = $0.2 + 6.2 \times \text{age}$; $P < 0.05$). The older goats and the most dominant ones seemed to be the most anxious when alone in the test pen (on the basis of the number of cries, excretions, movements and eating refusals).

Behaviour during milking

The order of passage through the milking parlour was similar for the two milkings observed ($P < 0.05$), and highly (positively) correlated with the articular pathologies ($P < 0.05$). Older animals had more limb problems ($P < 0.05$). Moreover, animals with limb lesions hesitated or showed more refusals to get on the ramp to the milking

parlour ($P < 0.05$). The order of passage on the ramp was negatively correlated with the dominance index ($r = -0.424$, $P < 0.01$). The number of hesitations to get on the milking parlour ramp was positively correlated with the number of antagonistic interactions received from other animals ($r = 0.57$, $P < 0.001$).

Lameness and standing up

The mean score for lameness was 1.43 and 5 animals (12.5%) presented severe lameness (score 3 or 4). The mean score for standing up was 1.37 and 3 animals (8.5%) had difficulties standing up (score 3). These two variables were highly correlated ($r = 0.54$, $P < 0.001$).

Discussion

As observed by Vandenhede *et al* (1998), stressed animals moved and cried more than the others. Differences in intensity and frequency of vocalisations between calm animals and agitated ones were observed. Some of the animals tested exhibited an aversion to the non-familiar person, especially when the person was moving. In most cases, they calmed down after a while, but some never became comfortable with the situation. A large number of this kind of animal could indicate a problem with human socialisation. As observed by Beausoleil *et al* (2005), goats showed more aversion to a dog than to an immobile person; but a moving person was more fear-eliciting than a dog. A difference was identified between anxious and calm animals, but in the former, a further study using physiological parameters would be necessary to rank them. During this test, some animals presented extreme fear reactions likely to severely compromise welfare.

Dominant, intermediate and subordinate animals were identified in the flock. Some of the subordinate ones received only one or two antagonistic interactions but some received more and from several animals (one goat received 28 interactions in 3 hours). If the space allowed to the animals and food distribution are not appropriate, the most dominated goats could lack social relationships, food, or a resting place (Barroso *et al* 2000). There was a tendency for stability in the hierarchy of the younger animals whereas fights for rank were greater among the older ones. The nature of the reaction (displacing, supplanting, frightening or assaulting) can give information about the stability of the hierarchy within the group. While dominant animals were more anxious alone, the contrary occurred for the subordinate ones.

The articular pathologies experienced by older animals resulted in more aversion to get onto the ramp to the milking parlour. If this aversion is too strong, chronic stress or fear at the milking parlour could arise. Dominance was related to the order of passage in the milking parlour and to emotional reactivity.

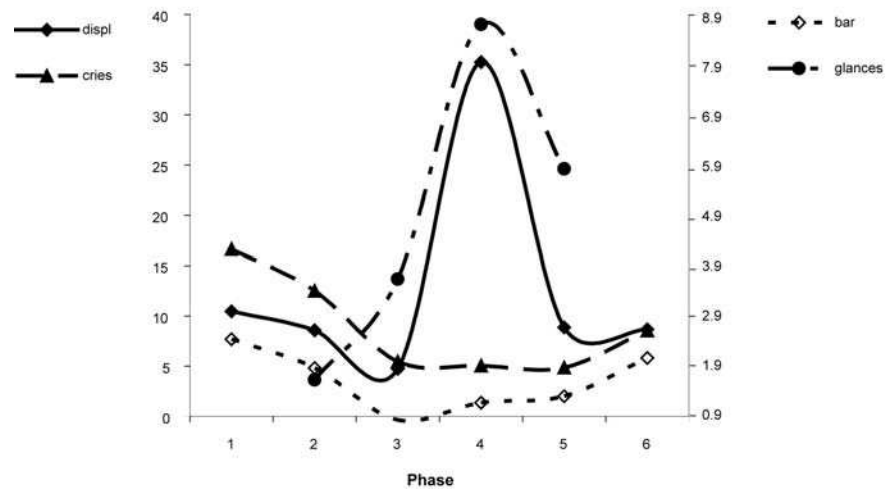
Animal welfare implications

These tests are directly linked to animal welfare: age and pathology (particularly limb problems) can be a source of

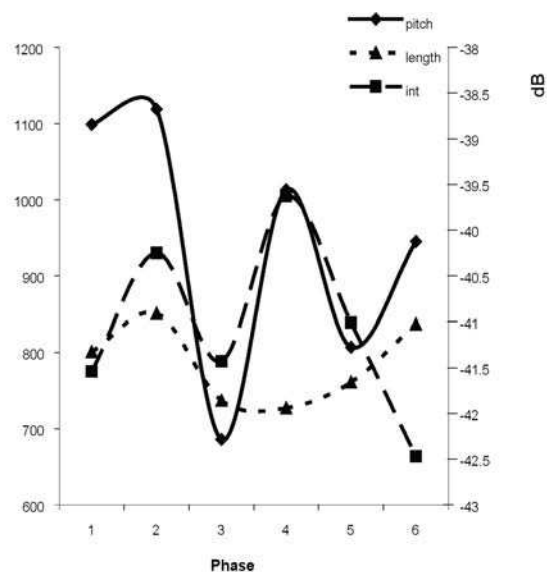
Figure 1

Mean of different variables during the 6 phases of the emotional reactivity test.

In 1) (adjusted to 3 min) and 6): animals alone. 2) cone, 3) immobile non-familiar person, 4) moving non-familiar person, 5) immobile dog. Left scale: displ: number of movements of the animal, cries: number of cries. Right scale: glances: number of glances in direction of the stimulus. bar: number of attempts to get out.

**Figure 2**

Means of qualitative variables for emitted sounds during the 6 phases of the emotional reactivity test. Left scale: pitch: frequency of the cries (Hz); length: length of the cries (ms). Right scale: int.: intensity of the cries (dB).



inconvenience for dairy goats, frequent or inadequate batch management can frighten the animals or disturb social relationships, and lack of socialisation to humans may be a problem due to the importance of interactions between humans and flock. Further observations performed on a large number of animals and farms would contribute to determining the welfare relevance, the repeatability and the feasibility of these tests and to establishing references in terms of animal welfare for this type of production system. In a simplified form such tests could be used for on-farm evaluation of dairy goat welfare.

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