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Are cows that consistently enter the same side of a two-sided milking parlour more fearful of novel situations or more competitive

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Abstract

Two groups of twelve dairy cows were identified from a group of 70 cows according to the consistency with which they voluntarily entered one of two sides of a milking parlour during 25 milkings. The mean proportion for High Consistency cows (HC) was 91% (range 86-97%), and for the Not Consistent cows (NC), 60% (range 50-71%). We examined whether this characteristic was related to their behaviour in a novel environment or to their ability to gain food in a competitive environment. The cows were observed individually in the novel environment, an empty pen near the parlour, for 15 minutes after milking They were then subjected to a food-competition test, in which a particular cow was introduced to the pen and they were provided with a bucket of feed. This lasted for a maximum of 15 minutes or until the two cows stopped interacting or

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feeding. In the empty pen test, HC cows spent longer standing motionless (mean 665 s) than NC cows (mean 521 s, which may indicate increased fear. However, the time spent sniffing the pen and the number of steps and vocalisations was similar for the HC and NC cows. In the food competition test, HC cows took less time to start feeding (70 s) than NC cows (137 s) and spent considerably more time in control of the food bucket (HC 151 s, NC 19 s). They also instigated more aggressive interactions (HC 3.4, NC 0.6) and tended to push the other cow more times (HC 2.8, NC 0.5). HC cows stood inactive for longer (222s) than NC cows (373 s). Thus there was some evidence that cows consistently entering one side of the parlour were more fearful in novel situations, but substantial evidence that they were more dominant over other cows in gaining access to resources.

Keywords: Cattle, Milking, Competition, Food, Dominance, Social Strategies, Coping.

1. Introduction

Behavioural strategies are often the essential factors for success in a social environment. Coping strategies are associated with individual characteristics, such as anxiety and fear, which can have a significant effect on the ability of an animal to cope with its environment through increased or prolonged stress-responses (Benus et al., 1990; Boissy, 1995; Boissy and Bouissou, 1995; von Borell, 1995, Broom 2001). Individual characteristics and coping strategies may determine the extent to which these challenges threaten the animal and thus welfare including health (Broom, 1993; von Borell, 1995; Koolhaas, 1997). The success of a strategy depends on its effectiveness in attenuating any harmful effects on physiology (Wechsler, 1995) and associated immunological parameters and stress pathology (Ursin and

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Olff, 1993). An animal with a high level of anxiety has a lower threshold in eliciting a stress-response and may have an increased need for predictability and controllability (von Borell,1995). In mice, anxiety is correlated with aggressiveness and perceived risk (Guillot and Chapouthier 1996; Ferrari et al., 1998). Benus et al. (1990) found that aggressive mice are less able to change a learned routine in a social situation than non-aggressive mice. Aggressive animals might form a routine as part of their behavioural strategy to cope with a challenge. Hansen and Damgaard (1993) suggest that individual differences in the need for predictability and controllability might determine the characteristic differences of animals.

Cows in a loose-housing environment are frequently exposed to potential threats and challenges. These can arise due to different management practices like handling, milking, forced movement and veterinary procedures, or due to social confrontations when crowded or being moved to another group. In milking parlours with two sides, some cows exhibit a preference to consistently enter one side (Hopster et al., 1998; Paranhos da Costa and Broom, 2001), providing evidence of formation of a routine (Hopster et al., 1998). Neveu (1996) suggests that behavioural lateralization might be associated with specific immunological and neuroendocrine parameters. But side preference could also reveal differences in sensitivity towards a possibly aversive situation resulting from previous human or cow behaviour. Grandin et al. (1994) showed that cattle generally tend to stay in a routine once they have learned that one side is aversive in a Y-maze even when the aversive and normal side are switched. Hence, sensitivity towards challenges or perceived threats in the milking parlour may be more important determinants of behaviour than mere formation of routines. Hansen and Damgaard (1993) suggest that coping strategies could be interpreted as differences in the need for predictability and controllability. A cow creating a routine in the daily exposures to the milking parlour might therefore be a cow with a strong requirement for predictability and

controllability, although Paranhos da Costa and Broom (2001) did not find that cows which went to the non-preferred side showed adverse effects. Side preference could also be a way of coping with the milking parlour situation for some cows independent of the strength of any perceived threat. The side preference could be a consequence of physical asymmetry, or on effect of crowding which involves no perceived threat.

Side preference might thus be a way to differentiate between cows with different individual characteristics, e.g. in routine formation or anxiety, or strategy for coping with the milking parlour and the milking process. It could also indicate differences in the ability of cows to achieve their goal, reaching a specific side of the parlour, which may be difficult in a crowded environment.

The aim of this study was to examine whether side preference in the milking parlour is associated with differences in individual characteristics, in particular behavioural coping strategies in a challenging situation. Cows known to be consistent or inconsistent in their choice of parlour side were therefore subjected to a non-social and a social challenging test and observed in the straw-yard during feeding.

2. Materials and methods

2.1 Animals and housing

Two groups of Holstein-Friesian dairy cows were identified in relation to their consistency of visiting the same side of a two-sided milking parlour (Figure 1): twelve cows that regularly visited the same side and twelve cows that visited both sides regularly. Details of the methods of identifying these two groups and the effects on

behaviour and milk production are described by Paranhos da Costa and Broom (2001). Briefly, 70 high-yielding cows were observed for their order of entry to a 20 stall rapid exit parlour (Alfa-Laval UK Ltd) during a minimum of 25 milkings/cow. They were then classified as showing a high consistency of entry into one side of the parlour (mean 91.2% of milkings in one side, range 86.1 to 97.2%, shown by 33% of cows), medium consistency (mean 77.0% of milkings in one side, range 72.2 to 82.9%, shown by 23% of cows) or not consistent (mean 59.9% of milkings in one side, range 50.0 to 71.4, shown by 44% of cows). For this study, 12 high consistency (HC) and 12 not consistent (NC) cows were available and were kept with other cows in the herd in strawed pens with a concrete feeding passage. For the behaviour observations in the unfamiliar environment and during competition for food, each experimental cow was automatically detained after afternoon milking, which commenced at 15.15 h. The study was carried out between November 1999 and January, 2000.

2.2 Behaviour observations

Baseline data on the the behaviour of the cows in the two treatments were obtained first in the straw yard where they were housed. Second their behaviour was observed in response to an unfamiliar environment, and in a situation where there was competition for food between two cows.

2.2.1 Observations in the straw-yard

Individual members of the two groups of cows were continuously observed for two hours each, from 12.00 to 14.00 h, with two observers each day. The behaviours observed during feeding were: lying, standing in passage, aggression, (instigated or received) and

displacement of other cows through aggression (causing displacement or being displaced).

2.2.2 Observations in the unfamiliar environment

The behavioural reactions of cows in the two treatments were observed in an empty pen, which represented an unfamiliar environment. After milking in the afternoon, a cow was isolated in the pen for 15 minutes, with the cows being alternated from the two treatments daily. The pen was close to the milking parlour, of dimensions 5 x 5 m, two of the four sides being walls of the building, the other two being of iron bars (Figure1). The following behaviours (with units) were continuously measured by an observer for the 15 min. period: sniffing the pen (s); grooming themselves (s); ruminating (s); taking steps (number); vocalisation (number); defaecating (number); urinating (number); shaking their head (number) and standing inactive (not engaged in any other recorded activity) (s). Standing behaviour was characterised for the different areas of the pen, but as there was no difference in position between cows in the two treatments, results are presented as a mean value.

2.2.3 Observations during the food-competition test

Following the unfamiliar environment test, a test cow (the same animal for all tests) and a bucket containing 3 kg of chopped potatoes were introduced into the pen. Behaviour was observed for 15 minutes or until the cows had consumed the potatoes and had ceased to interact for one minute by remaining more than 2 m from each other. The following behaviours (with units) were observed continuously for the duration of the test: feeding (s); latency to feeding (s); standing inactive (not engaged in any other recorded activity) (s and % of total time); in control of bucket (head 0.5 m or less from bucket without

interference of other cow (s); steps (number); aggression (malevolent act causing displacement of other cow) instigated or received (number); push with head (number); fighting (reciprocal pushing) (s); licking/sniffing the other cow (s).

2.3 Statistical analysis

For all three situations in which the animals were observed, the differences in behaviour between the HC cows and the NC cows were examined by an analysis of variance model (ANOVA). For this purpose, some data had to be transformed to a normal distribution by taking the square root, logarithm or arcsine, and transformed back for presentation. For data that could not be transformed to a normal distribution, analysis was by the Kruskal Wallace test. The correlations of the behaviours within each observed situation and between the situations were analysed by Pearson Correlation Coefficients.

3. Results

3.1 Observations in the strawed yard

No behaviours in the straw-yard were different for HC or NC cows (Table 1 (P>0.10). The results were therefore used only in relation to behaviour in the two test situations.

3.2 Observations in the unfamiliar environment

The cows with a consistent parlour side selection spent longer standing motionless than inconsistent cows, but there were no differences between treatments in the other behaviours recorded (Table 2). Only two cows ruminated and there was less than one urination, defaecation or shaking of the head observed per cow, so results are not presented.

3.2 Observations during the food-competition test

The test lasted longer for NC than for HC cows (Table 3). There was considerable variation in feeding duration, especially in HC cows but this difference was not significant. The HC cows took take less time to start feeding than NC cows and they were also in control of the bucket for considerably longer. Cows in both groups spent a similar amount of time looking at the bucket and walking in the pen. The consistent cows instigated more aggression than inconsistent cows, but both groups received a similar amount of aggression. The total involvement of the HC cows in aggressive acts was greater than the NC cows. This increase in aggression in the HC cows was in pushing and was not reciprocated in the form of fighting. HC and NC cows showed a similar amount of affiliative behaviour, licking and sniffing. The HC cows were standing inactive for less time than the NC cows, both in duration and as a proportion of total time.

When the relationships between the measures during the different tests were investigated, it was found that: cows which vocalised more in the unfamiliar environment showed more successful feeding attempts in the food competition test ($P=0.05$ Fig. 2a), cows which were more aggressive in the food competiton test caused more displacements in the straw yard ($P<0.004$ Fig. 2b) and cows which were more aggressive in the straw yard spent more time standing in the section furthest from the bucket in the food competition test ($P<0.01$ Fig. 2c).

4. Discussion

The HC cows, those which were consistent in their side preference in the milking parlour, appeared to have more social competence, or more successful social strategies, than NC cows in the food-competition test. HC cows were quicker to gain access to the food bucket, spent more time in control of the bucket, were more often involved in aggressive interactions and caused more displacements. The NC cows, those which were not consistent in the side of the milking parlour visited, spent more time standing motionless and to be less competent in the social competiton situation. There may also have been differences in motivation or ambition to reach a goal.

There was a great variation in feeding behaviour between the animals, especially in the HC cows, during the competition test. Just a few of the animals actually succeeded in feeding despite the presence of the test cow and these also instigated most aggressive actions. The amount of time the animals were in control of the bucket also varied to a great extent between the animals. In addition, the test cow, which was used throughout the test to eliminate inter-individual differences, became more adapted and thus better at competing over the period of the tests.

Cows which were consistent in their use of the parlour (HC) showed more pushing in the feed competition test. This suggests that HC and NC cows perform different social strategies to reach a goal, the strategy of the cows with a side preference being more successful. It is likely that the NC cows were in a greater state of tension due to the unfamiliar test environment they were subjected to and due to the separation from the group. The vocalisation frequency in the unfamiliar environment test was positively correlated with the number of successful feeding attempts in the paired food-competition test (Figure 2a).

Vocalisation has been associated with arousal in several studies (von Borell and Ladewig, 1992; Lidfors, 1996; Zimmerman and Koene, 1998).

Cows with a side preference apparently had a higher status than the cows without a side preference in the milking parlour. Wierenga et al. (1990) found a positive correlation between dominance status and number of displacements caused, and in this study, the cows with a side preference caused more displacements in the straw yard. Differences in coping strategies can be the cause of differences in social status. Koolhaas and Bohus (1989) found in rodents, for example, that the individual behavioural strategy determined the social status of that animal. Hilakivi-Clarke and Lister (1992) suggested that the social strategies are a consequence rather than a cause of the position in the social hierarchy.

Distinctive behavioural strategies used by an animal in a novel and challenging situation may predict its behaviour in a group (Mendl and Deag 1995),. This was the case in some behaviours as shown by the inter-test correlations. The more aggressive animals in the paired food-competition test were the ones causing more displacements in the straw-yard, which can be considered an effect of successful aggressive behaviour (Figure 2 b). The cows exhibiting more aggressive actions in the straw-yard spent more time at a greater distance during the paired food-competition test (Figure 2c), and the cows spending more time at a greater distance in the paired food-competition test, were in control of the bucket for less time. This could indicate that the success of a cow in a social situation can be predicted by her level of aggressiveness as well as by the frequency of displacements she causes in a group. Wierenga (1990) suggested that dominant animals do not need to be the most aggressive. Possibly it is the more subordinate animals that show more aggressive actions to improve their status. In

rodents, however, there was an inverse association found between aggressiveness and dominance status (Benus 1987).

In a group, the animals might in general show less aggressive actions because of an existing hierarchy. Jensen (1995) argues that behavioural strategies in a novel and challenging situation cannot predict the behaviour in a group once it is established. It is possible that a social test is better able to predict the behaviour in a group than a non-social challenge since it is the social environment that shapes the behaviour in a group. It appears that the frequency of showing aggressive actions, the amount of time controlling the bucket and the feeding time in the paired food-competition test are positively correlated with the frequency of non-aggressive actions received. In the straw-yard the HC cows received more non-aggressive actions, which consisted mainly of licking, than the NC cows, while the amount of non-aggressive actions displayed was the same in both groups. If the paired food-competition test can predict the behaviour in the group, this would be an indication that the HC cows are probably also more competent socially in the group. Sato et al. (1991) described the function of social-licking as possibly being a reduction of tension. They suggest that licking is independent of social dominance, but being licked more could indicate a greater social competence.

The question remains whether the situations in which the behaviour was observed can really be usefully compared. Spoolder et al. (1996) found no inter-situation consistency between four different tests in gilts, one of them being an open-field test, one a food-competition test and one observations of general activity and feeding behaviour in a group. Mormède et al. (1990) found that different challenges also triggered different neuroendocrine changes in rats. Jensen (1995) and Spoolder (1996) argue that if there is no inter-test consistency, the

existence of different behavioural strategies cannot be demonstrated. In other studies it is concluded that test situations reveal individual behavioural strategies which are utilised in other challenging situations (Benus et al., 1990; Hessing et al., 1993; Boissy, 1995; Boissy and Bouissou, 1995). In this study the correlations between the same categories of behaviour in the paired food-competition test and the straw-yard lends confidence to the proposal that the consistency of parlour side-choice demonstrates a personality trait indicating confidence in social situations.

Conclusion

The main difference found in behaviour between the HC cows and the NC cows concerned interaction and success in the paired food-competition test. This might indicate the existence of different social strategies. It is probable that all cows tend to form a routine, but only some succeed due to social inhibition in the waiting area of the milking parlour. Consistency in the parlour could differentiate between cows with more or less successful social strategies.

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