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The motivation of dairy cows for access to pasture

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ABSTRACT

Several factors influence whether dairy cattle prefer to be indoors or at pasture, including weather conditions and milk yield, but it is unclear how motivated cows are for access to pasture. One way to measure motivation is to require the animal to work (e.g., walk different distances) for access to a resource. This study investigated whether pasture access located 60, 140, or 260 m from the indoor housing would affect the proportion of time dairy cows spent at pasture. Thirty-two Holstein-Friesian dairy cows were used during the study, which took place in the United Kingdom from May to July 2010. The experiment consisted of four 18-d experimental periods, with 8 cows in each period, which were further divided into 2 groups of 4 cows. Following a training period, the cows were randomly allocated to distances of 60, 140, or 260 m to pasture over three 4-d measurement periods. A video camera was used to record time spent indoors and outdoors 24 h/d, and manual behavior observations (0700 to 2200 h) took place 6 times during each period to record how the cows spent their time in each location. The video data showed that cows spent, on average, 57.8% (± 3.44) of their time outside (either at pasture or on the track). One-sample *t*-tests revealed that this value was different from 0% ($t = 16.80$), 50% ($t = 2.26$), and 100% ($t = -12.28$). Analysis of the percentage time spent outside revealed that distance did not influence nighttime pasture use (2100 to 0430 h; $F_{2,8} = 0.16$; 81.0% vs. 81.0% vs. 76.7%, for 60 m vs. 140 m vs. 260 m, respectively). In contrast, during the day (0700 to 2100 h; from behavior observations), time spent at pasture declined as distance increased; that is, cows spent more time at pasture when they had to walk 60 m ($F_{2,80} = 10.09$) than when they had to walk 140 or 260 m (45.3% vs. 27.4% vs. 21.2%, respectively). Time spent at pasture decreased on rainy days ($y = -1.0672x + 59.646$, $R^2 = 0.09$, $n = 48$ d), but the indoor temperature-humidity index (THI), the outdoor THI, and body

condition score did not influence time spent outside. Under the climatic conditions of the current study in the United Kingdom, cows had a partial preference for pasture, which was influenced by distance to pasture during daytime but not at night. This shows that dairy cows were more motivated to access pasture at night compared with during the day.

Key words: welfare, behavior, housing, motivation

INTRODUCTION

Pasture is a natural environment for dairy cattle but it is more common for cattle to be housed indoors in North America and the United Kingdom, if not year round, then at least for the winter months (Haskell et al., 2006). Indoor housing, such as freestall systems, can restrict the expression of natural behaviors, but does allow greater control of feeding, allowing cattle to meet their nutritional demands, which is not always possible at pasture. Allowing cattle to choose whether to spend their time indoors or at pasture can provide information on whether they have a preference for one location over the other. A previous study showed that, when given a choice, cows made an initial decision to go to pasture on 66% of occasions, but overall they expressed a partial preference to be indoors, spending 91.9% of their time inside (Charlton et al., 2011a). In contrast, a subsequent experiment (Charlton et al., 2011b) showed that cows expressed a partial preference for pasture, spending over 70% of their time outdoors. One of the main differences between the 2 experiments was the distance the cows walked to access pasture. During the study by Charlton et al. (2011a), the cows were required to walk over 90 m from the indoor housing to pasture, whereas in the follow-up study, the 2 locations were separated by only 40 m (Charlton et al., 2011b). How far cattle are prepared to walk to access pasture may indicate the importance of pasture, but from Charlton et al. (2011a) it is unclear whether their partial preference to be indoors was influenced by distance. This is a limitation of preference testing; it fails to provide information on the strength of preference and whether a commodity or environment is preferred or avoided (Fraser and Matthews, 1997). Motivational

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tests can be useful to determine the behavioral needs of an animal (Edwards, 2010). One approach is to use operant conditioning techniques, where motivational strengths are measured by imposing an increasing cost of access to perform particular behaviors (Jensen and Pedersen, 2008).

In a study by Schütz et al. (2006), walking distance was used as a measure of motivation. Cows deprived of food for 0, 3, 6, or 9 h could walk an increasing distance to obtain a fixed food reward. The starting distance was 20 m, which increased by 20 m following each food reward. Treatment had a significant effect on distance walked: lactating cows deprived of food for 6 h walked an average of 64.7 m and those deprived for 9 h walked an average of 76.9 m, compared with only 30.7 m for cows that had not been food deprived. These findings indicate that walking distance is a suitable measure of motivation.

To test whether cows would be motivated to return to the barn to use an automatic milking system (AMS), Ketelaar-de Lauwere et al. (2000) allowed cows access to pasture located 360 m from the barn. The results showed that the cows preferred to lie on pasture than indoors in stalls, and they did not reduce their visits to the AMS despite having to walk 360 m. In contrast, when cows could access pasture 50 or 260 m from the indoor housing with an AMS, Spöndly and Wredle (2004) found that those with access to distant pasture (260 m) reduced their pasture use. With contradictory results, it is unclear how motivated cows are to access pasture and how far they are prepared to walk. The aim of the current study was to investigate the effects of providing cows with pasture access 60, 140, or 260 m from the indoor housing, and to establish if it would influence time spent on pasture and cow behavior.

MATERIALS AND METHODS

Animals and Management

The study was carried out at Harper Adams University College, Shropshire, United Kingdom (52°47'N; 2°26'W) using 32 pregnant Holstein-Friesian dairy cows (9 primiparous and 23 multiparous). The majority of

the cows were in mid to late lactation (270 ± 17.8 DIM, mean \pm SEM; range: 33 to 483 DIM), producing between 16.0 to 61.5 kg/d (mean 28.2 ± 1.59 kg/d). The cows were selected based on milk yield, and any cow with a lameness score greater than 2 (according to Flower and Weary, 2006) was excluded from the study. The cows were allocated to 1 of 4 experimental periods ($n = 8 \times 4$), which were carried out from May 17 to July 27, 2010 (study period 1: May 17 to June 3; study period 2: June 4 to June 21; study period 3: June 22 to July 9; and study period 4: July 10 to July 27, inclusive). Within each period, the 8 cows were further divided into 2 groups: group 1 ($n = 4$) and group 2 ($n = 4$). The cows were initially divided into groups using random allocation; however, if milk yield differed significantly between the 2 groups, then they were re-selected until no significant difference was found. Each experimental period lasted for a total of 18 d: 4 d of training followed by three 4-d study periods, with a training day between each study period (Figure 1). During the three 4-d study periods, each group would walk 60, 140, or 260 m to pasture in a random order. During the training days, the cows were encouraged to walk from the housing to the pasture and vice versa at various times during the day, to ensure they were aware they had free choice between the 2 locations, and to familiarize them with the access gates to and from the pasture.

Before the study, the cows were typically housed indoors in a freestall barn from November to April and allowed access to pasture from April to October or November, depending on the weather conditions. Ethical approval for the study was given by Harper Adams University College Research Ethics Committee.

Experimental Design and Housing

Twice a day, at 0430 and 1500 h, the cows were collected and taken to the milking parlor with the rest of the herd and milked in a 40-point internal rotary parlor (Westfalia Surge, Milton Keynes, UK). No concentrates were fed during milking. Following the morning (approximately 0645 h) and afternoon (approx-

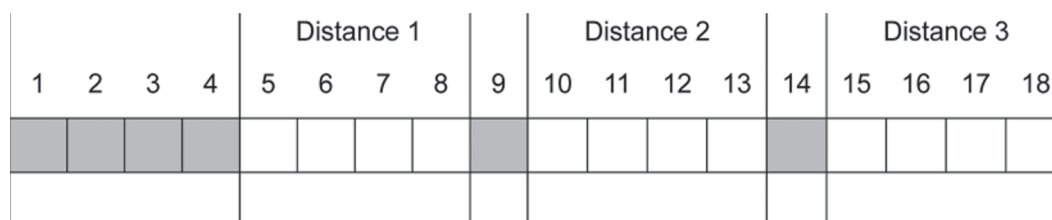


Figure 1. Representation of the 18-d study period, which was repeated 4 times using 8 cows. Shaded areas represent training days.

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