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Animal behaviour and pasture depletion in a pasture-based automatic milking system

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Introduction

In an automatic milking system (AMS) feed is used as an incentive to encourage voluntary and distributed cow traffic to the milking unit (Prescott *et al.* 1998). Therefore the timing, placement and size of feed allocations need to be managed in order to achieve targeted milking events per day.

Behavioural studies allow the construction of time budgets (Gibb *et al.* 1998), and aid understanding of how cows modify their behaviour under different management regimes (Johansson *et al.* 1999). To date there are no published reports on how different location of feed incentives affect cows' behaviour upon arrival at a pasture allocation in pasture-based AMS.

A behavioural study was conducted in a pasture-based AMS where cows received supplementary feed either prior to (PRE), or immediately after (POST) milking. It was hypothesised that as PRE cows would have spent comparatively more time than POST cows since they ate their respective allocation of supplementary feed (at the time of exiting the dairy), they would be more motivated to go to the paddock in search of additional feed. Thus they would graze more intensively once they entered their pasture allocation.

Material and Methods

The observation study was conducted in spring 2011 at the FutureDairy AMS research farm (Camden, NSW, Australia). The herd consisted of 175 mixed age and breed cows that were milked using a 16-unit prototype robotic rotary (RR; Automatic Milking Rotary, DeLaval, Tumba, Sweden; Kolbach *et al.* 2013). All cows had a 4 h minimum milking interval, after which milking permission was granted.

Cows were randomly assigned to 2 groups but managed together as one single herd. Treatments were then allocated to each group in a cross-over study with 2 periods of 13 days each. Each period comprised a 7-day adaptation period followed by 6-day period of data collection.

Target dry matter intake was set at 23 kg DM/cow/day. On average, 60% of daily DMI was supplied as grazable pasture (predominantly Ryegrass - *Lolium perenne* and *Lolium multiflorum*) in 2 allocations per day with 40:60 DM allowance in day and night allocations respectively.

The remaining 40% was offered as supplementary feed in a feeding area at the dairy, consisting of pelleted concentrates (12% of daily DMI) offered through 4 automatic feed stations (FSC400, DeLaval, Tumba, Sweden) and a partial mixed ration (PMR, 28% of daily DMI, with 11% cereal hay, 44% maize silage and 44% pelleted concentrate, as % PMR total DM). Cows accessed each allocation for a consistent 12 h period of time and had an additional 10 h in which they were expected to voluntarily exit the allocation. Any cows that did not voluntarily exit a paddock were fetched and encouraged from the paddock to the dairy 2 h prior to the subsequent allocation closing for access.

Fifteen cows within each group were randomly selected as observation cows. Instantaneous sampling on observation animals was conducted and recorded by trained observers every 15 min throughout 24 h (commencing 0700 h and finishing 0700 h the subsequent day) on the second and fourth day of each treatment period (total of 4 x 24 h periods). *Presence* was used to record the presence or absence of each observation cow at the time of each observation in a particular pasture allocation. Grazing (animal with head close to forage sward, and actively searching or removing pasture from the canopy) or *other* (which included any activity that was not grazing, such as ruminating, idling, social interaction) behaviours were also recorded. Additionally, *bite rate* was recorded once every hour by counting the number of bites taken per minute for at least 5 cows that were actively grazing.

The proportion of cows present in the pasture allocation was described using Kaplan-Meier survival curves, whereas the behaviour data were analysed using linear mixed model (REML) and generalised linear mixed models (GLMM).

Results and Discussion

The PRE cows started exiting the allocation 6 h after entering an allocation, whereas the POST cows started exiting 8 h after entering (Fig. 1a). There was no difference ($P=0.928$) between treatments in the proportion of cows 'grazing' in relation to the time since exiting the dairy. A higher ($P = 0.009$) proportion of cows grazed during the first hour after exiting the dairy. There was neither an effect ($P>0.100$) of time nor of treatment on bite rate. The average bite rate was 40 ± 1 bites/min.

The higher proportion of cows grazing during the first

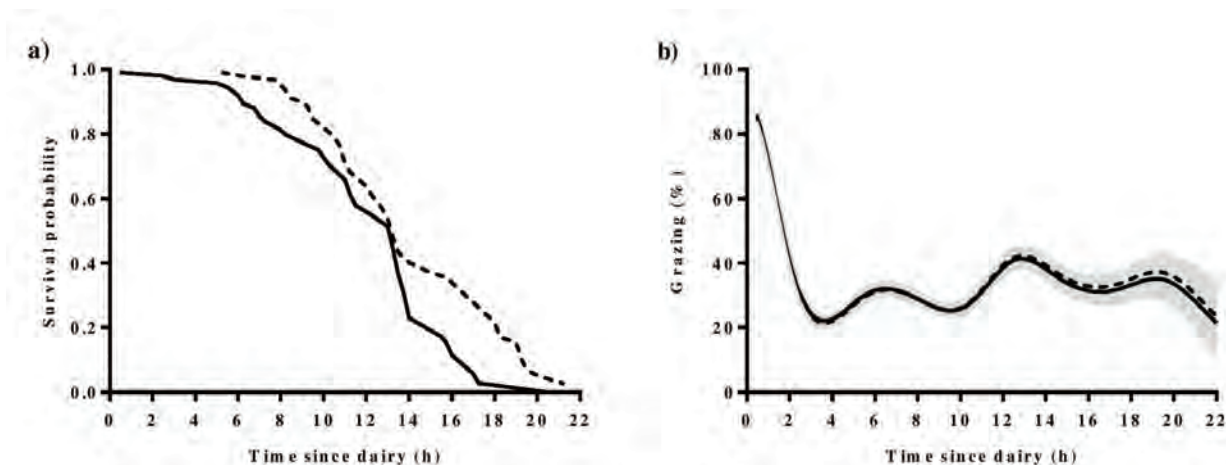


Figure 1. Kaplan Meier curves for cows present (1a) and that are grazing (1b) in the pasture allocation (at time since exiting the dairy) in a pasture-based automatic milking system when supplementary feed is provided either prior to (PRE; solid line) or immediately after (POST; dashed line) milking.

hour confirms previous studies in which access to fresh pasture acted as stimuli strong enough to initiate consumption (Gregorini *et al.* 2009). The higher proportion of cows grazing at 6 h, 12 h and 19 h after entering the allocation, also confirms the likelihood of cows to perform grazing in bouts, separated by periods of ruminating or idling (Gibb *et al.* 1997). The behaviour observed whilst cows were in an allocation, together with the rate at which cows exited the paddock confirms that PRE feeding is a strong incentive to encourage cows to traffic from pasture to the dairy. However, cows' response to feed availability and behaviour whilst on pasture is influenced more by pasture cover than supplementary feed location.

Conclusion

Cow spent at least 6 to 8 h in the pasture allocation, and similar grazing behaviour (time and bite rate) could be observed between treatments.

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