Effect of indoor silage feeding on pasture time in a batch-milked automatic milking rotary system

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Abstract

The effect of indoor silage feeding on pasture time was studied in an automatic milking rotary system with batch milking two times daily. The objective was to study how pasture time is influenced by offering only pasture (PP) or both grass silage and pasture (SP) in the barn during grazing hours, in a night-time grazing system, where cows could move freely between barn and pasture during pasturing hours. From 9 June until 18 August, treatments SP and PP were repeated three and two times, respectively in two-week periods using the second week for measurements. During each measurement week, ten animals were fitted with HOBO® loggers that estimated grazing time from head position. Results were analysed in a mixed repeated measurement model using only cows (83) present during all periods. Results showed that animals on treatment PP spent approximately 8.5 hours on pasture with no difference between primi- and multiparous cows. In contrast, cows on treatment SP spent less time on pasture (P<0.001) and furthermore, time on pasture differed significantly between ages (P<0.001) in this group, with 4.7 h and 5.9 h for primiparous and multiparous cows, respectively. Analysis of data on the grazing hours, obtained from the HOBO loggers, showed a significant (P<0.001) difference between treatments with 3.8 and 2.2 hours of grazing on treatment PP and SP, respectively.

Keywords: night-time grazing, grazing time, pasture, indoor silage, premiparous, multiparous

Introduction

Farmers with intensive milk production systems generally aim at a high milk production as their main goal. Investing in automatic milking on the farm is a substantial cost and often leads to intensification of production. The automatic milking rotary (AMR™) is a system mainly designed for larger herds and it has been studied in several experiments in Australia under voluntary milking with pasture as the main roughage in the diet (Kolbach, 2012). However, in countries with a short grazing season, such as in Scandinavia, cows are often accustomed to eating large quantities of roughage in the barn and it is common to feed substantial amounts of supplementary silage indoors during the grazing season. With increasing automation combined with larger herd sizes, the difficulties in logistics and cow traffic with pasture have increased and farmers may prefer to keep their lactating cows in the barn throughout the year. However, it has been shown that grazing and pasture have beneficial effects on cow health and welfare and therefore it is important to find pasture management systems adapted for large herds with intensive production. The objective of this study was to analyse the effects of silage supplementation on cow traffic and choice of location of cows in an intensively managed AMR barn.

Material and methods

The experiment was performed with 83 cows in a group of approximately 120 cows in an AMR barn with batch milking two times daily. The cows were predominately (61 cows) of the Swedish Red breed (SR) and remaining animals (22) were of the breed Swedish-Holstein From 9 June until 18 August, cows in the barn were subjected to two treatments, each applied repeatedly during two-week periods, with the first week acting as an adaptation period and the second week used as a registration period. The cows were allowed to go on pasture approximately 12 hours at night, between evening and morning milkings. They were herded out to the pasture area after evening milking and thereafter allowed to move freely between

barn and pasture throughout the night. Starting on 9 June, cows were offered pasture (P) with *ad libitum* access to grass silage (S) indoors during grazing hours during the first two-week period, treatment (SP). In the following two-week period, cows had only pasture as roughage during the hours they had access to the pasture area, treatment (PP). The treatment SP and PP were repeated until the end of the experiment, giving a total of three periods with SP and two periods with PP. During the day hours, when the cows were confined in the barn, they always had free access to grass silage. Concentrates were fed according to milk production at the latest test milking occasion, according to the same routines for both treatments, and drinking water was available only in the barn. Cow traffic between barn and pasture was registered automatically at an individual level.

During registration weeks, 12 cows were fitted with HOBO loggers that were attached to the halter. The 3D loggers register the tilt of the head. This equipment has been validated and can, according to Nielsen (2013), be used as a tool to distinguish between grazing and non-grazing behaviour. The methodology of the validation study mentioned above was also used in the present study.

Cows were in a rotational grazing system, rotating between 7 different larger (~3 ha) pasture fields. Rotation varied between 4 and 6 days grazing per field depending on sward conditions. Samples of pasture were collected daily and pasture samples were pooled over a one-week period while silage samples were pooled over two-week periods for analysis. Sward height of pasture was measured daily with a Jenquip plate meter.

The statistical analysis system (SAS version 9.3) was used for the analysis of the effect of treatment (SP vs PP) on the cow traffic variables: time spent outdoors, number of outdoor visits and length of each outdoor visit. The final model for the cow traffic variables was a mixed model with the independent variables treatment, week, lactation number and the interaction between treatment and week with cow×treatment as repeated subject. The same model was used for the statistical analysis of the grazing time calculated from the HOBO loggers, without the factor lactation number as the data set for the grazing time was based on only data from 10 multiparous cows. No significant effects of sward height or nutritive value of pasture were observed and these variables were therefore excluded from the statistical analysis.

Results and discussion

There was a significant interaction between treatment and parity. The average pasture traffic variables for treatments SP and PP for primiparous and multiparous cows are presented in Table 1. Cows with access to silage indoors (SP) had a high proportion of cows coming back early to the barn. During the three periods on this treatment, as much as 44, 53 and 33% of the cows returned to the barn before 22:00 p.m., respectively, i.e. approximately within four hours after being let out onto the pasture in the evening. In contrast, the cows in group PP returned later to the barn. During the two periods that cows were on treatment PP, 62 and 73% of the returns to the barn occurred between 01:00 and 06:00 in the morning while corresponding figures for the three periods with treatment SP were 41, 25 and 23%, respectively. The data in Table 1 are based on outdoor time for the 83 cows that were in the barn during the entire 10 weeks that the experiment lasted. All passages in and out of the barn during pasture hours over the five measurement weeks are the base for results of the statistical analysis in Table 1.

The analysis of the data from the HOBO loggers is based on data from ten cows only. Initially 12 cows were fitted with loggers, but data from two of these cows proved to give unrealistically high grazing hours that were around 98% of outdoor hours and therefore had to be excluded from the dataset. Furthermore, it seemed that some cows were disturbed by the loggers and on 8 occasions out of the total 50 observation weeks (10 cows × 5 weeks) the loggers were lost during the observation week leading to 16% missing values in the dataset. However, data from the remaining loggers showed that cows on treatment PP spent

Table 1. Outdoor hours (h) and number of outdoor visits for primiparous and multiparous cows with 12 hour night-time access to the pasture area and with only pasture (treatment PP), or with *ad libitum* silage in the barn (treatment SP) as roughage during the night. Least square means with standard error in parenthesis (n=83).[1]

	Treatment PP		Treatment SP	
	Primiparous	Multiparous	Primiparous	Multiparous
Outdoor time, h	8.4[a] (0.26)	8.6[a] (0.21)	4.7[b] (0.24)	5.9[c] (0.20)
Outdoor visits, no.	1.8[a] (0.04)	1.5[b] (0.04)	1.2[c] (0.04)	1.1[d] (0.03)

[1] Values with different superscripts in the same row differ significantly ($P<0.05$).

significantly ($P<0.001$) more time grazing (3.8 hours) compared with cows on treatment SP (2.2 hours). On the treatment SP, where cows were offered both pasture and supplementary silage during pasture hours, grazing time decreased as the grazing season progressed with 2.7 hours spent grazing in June and 1.7 hours in mid-August. As a contrast, the cows on treatment PP spent approximately the same amount of time grazing during both periods, 3.7 and 3.9 hours in the first and second period, respectively.

Due to dry weather conditions, the average content of metabolisable energy (ME) in the pasture was low with an average of 10.2 and 9.7 MJ ME per kg dry matter (DM), on treatment PP and SP, respectively. The average energy content of the supplementary silage was somewhat higher than the pasture, 10.5 MJ ME kg^{-1} DM.

The conclusion of the study is that offering supplementary silage in the barn during pasture hours decreases outdoor and grazing time for the animals, especially as the season progresses, thus reducing the potential health and welfare benefits of pasturing.

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