

Influence of feeding flavouring-appetizing substances on activity of cows in an automatic milking system

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ABSTRACT - Cow behaviour and milk production were evaluated depending on the presence or absence of flavouring and appetizing substances in the diet. Fifty-two Italian Friesian cows were blocked according to parity, DIM, milk yield and average number of previous visits during a two-week period before the start of the trial and divided into two groups. The experimental design was a change over, with two groups and two periods lasting four weeks. The compared treatments were: concentrate with addition of flavouring and appetizing substances (FAS) or without (C). Each experimental group including low (L) (<21 kg/d), mid (M) (21-28 kg/d), and high (H) (>28 kg/d) yielding cows at which were offered 1.5, 2.5, 3.5 kg/d of concentrate, respectively, in the automatic milking system (AMS) throughout the experiment. The cows generally consumed all the distributed FAS or C concentrate. The experiment showed that cow's behaviour was modified through the use of a appetizing component of the concentrate fed in the automatic dispenser of the AMS. Cows fed FAS concentrate increased the weekly visits without milking and milking frequency and decreased milking interval. Moreover, the use of the FAS concentrate reduced the number of milkings with intervals >11 hours by 5%. The greater milk yield of cows fed FAS could be a consequence of behaviour shift.

Key words: Automatic milking system, Cow traffic, Flavour concentrate, Milk yield.

Introduction - The application of the Automatic Milking Systems (AMS) represents a substantial innovation in the dairy industry, but it raises some questions about cow management. Various scientific reports showed that the main strategy to optimise AMS is to ensure correct cow traffic that permits cows to be milked as regularly as possible and continuously mixed with new subjects (Ronderburg and Wheeler, 2002; Wagner-Storch and Palmer, 2003). Milking frequency and the related average milking interval are decisive factors for achieving optimal use of AMS. A major difference compared with conventional milking is that milking is no longer fixed at regular times, but spread over the whole day. This leads to totally different milking behaviour, because each cow can set its own milking rhythm. The intervals between milking can be constant or totally variable, not only among animals but also among days at individual level. Correct and regular cow traffic through the milking unit appears to be fundamental in improving efficiency of AMS, animal welfare and performance. An elevated number of cows with a low frequency of visits to the AMS (unmotivated cows) is the major cause of robotic milking failure (Rodenburg and Wheeler, 2002). Motivation to feed, rather than to be milked, is a better incentive in attracting cows to the milking unit (Prescott et al., 1998), increasing the average number of milkings and minimizing the number of unmotivated cows. To minimize the unmotivated cow number, it is possible to increase the amount of concentrate delivered in the robot self-feeder. Alternatively, if an unduly high amount of concentrate is considered detrimental, the use of appetizing and flavouring substances can be considered. The aim of this study was to evaluate the effect of using flavouring and

appetizing substances included in the concentrate given through the robot automatic dispenser on the milking behaviour of cows fed concentrate in accordance with the milk yield.

Material and methods - The experiment was carried out at the *Porcellasco* farm of the *Consiglio per la Ricerca e Sperimentazione in Agricoltura* (CRA), Cremona, Italy. The experiment ran from March to May 2005 and was conducted with two AMSs. The cows were kept in a cubicle house with, on each side, a feeding area, a lying or separation area, a waiting area and the AMS (De Laval/VMS); the AMS entrance was in the waiting area. Cows could move from the feeding to the resting area passing through a one-way gate, and from the resting to the feeding area passing through the milking area. The small waiting area was close to the milking box and access was possible through the pre-selection gate, which selected and directed to the feeding area those cows which had been milked less than 5h before. The other cows were directed to the milking unit. Cows were stimulated to move to the pre-selection gate at 0600, when the mixed ration was distributed, and at 1600, when the stockman started barn cleaning operations and pushed up the total mixed ration. Twice a day at 08.00h and 17.00h only cows with a milking interval greater than 12h were fetched to the AMS. The AMSs were always accessible except during cleaning at 04.00, 12.00 and 20.00 for about 20min each time. The AMS feeding system consisted of two silos and two self-feeders, one for each side of the barn, so that it was possible to distribute the type and quantity of concentrate assigned to each treatment. The diet was formulated to meet nutrient recommendation for Holstein cows (650 kg BW) producing 28kg of milk. Fifty-two Italian Friesian cows were blocked according to parity, DIM, milk yield and average number of previous visits during a two-week period before the start of the trial and divided into two groups. The experimental design was a change over, with two groups and two periods lasting four weeks. The first week was for acclimatization, whereas the second, third and fourth were recording periods. The compared treatments were: concentrate with addition of flavouring and appetizing substances (FAS) or without (C). Each experimental group including low (L) (<21 kg/d), mid (M) (21-28 kg/d), and high (H) (>28 kg/d) yielding cows at which were offered 1.5, 2.5, 3.5 kg/d of concentrate, respectively, in the AMS throughout the experiment. The control concentrate was formulated with 30% of corn meal, 18% soybean meal, 15% dehydrated sugar beet pulp, 18% corn gluten feed, 5% sunflower meal, 8% wheat middlings, 2.5% sugarcane molasses, 3% buffer and 0.5% mineral-vitamin premix on DM basis. Based on tests carried out in previous trials (Migliorati et al., 2003) the experimental concentrate feed consisted of the same raw materials with the addition to the concentrate of flavouring-appetizing commercial substances: 150 g/t "Covotek Fenugreek" composed of fenugreek extract, cinnamaldehyde, gamma nonalactone, eugenol, benzaldehyde, vanillin, phenylacetic acid, 1,2 propylene glycol, water, silica; 500 g/t "Sucram N250" composed of sodium saccharin, carbohydrates, vanillin, maltol. The extracts were provided by Pancosma S.A. (Ginevra - Svizzera). Milk yield was recorded continuously in the AMS. Traffic data on the 52 cows was obtained from the recorded passages through the pre-selection gate and in the milking unit. Checks were conducted on: intake of concentrate in the milking box; visits to the pre-selection gate; milking frequency; visits without milking (visits with interval from last milking less than 5 hours); interval between visits to the pre-selection-gate; milking interval; milkings with intervals >11 hours and milk yield. Data were analyzed using the PROC MIXED procedures of SAS (SAS Inst. Inc., Cary, NC). Fixed effects were: treatment, period, week within period, productive level, treatment x period, treatment x productive level, treatment x period x productive level. Random effect was cow nested within productive level.

Results and conclusion - In Table 1 the effects of supplying cows with the concentrate of flavouring and appetizing substances are reported. Because there was no interaction between treatment and productive level, the statistical model was modified and this interaction was not considered, so that Table 1 reports only feeding treatment as main effect. The means of the effect of productive level were not reported, but only its significance.

Table 1. Effects of supply of concentrate feed with flavouring and appetizing substances (FAS) or without (C) on milk yield and milking parameters.

| | | Treatments | | SE | P | Effect of productive level |
|------------------------------|------------|------------|-------|-------|----|----------------------------|
| | | FAS | C | | | |
| Concentrate intake | kg/cow/day | 2.3 | 2.3 | 0.04 | ns | ** |
| Visits to pre-selection gate | n/cow/week | 40.6 | 39.4 | 2.01 | ns | ns |
| Pre-selection gate interval | hh.mm. | 04.52 | 05.06 | 00.14 | ns | * |
| Visits without milking | n/cow/week | 10.7 | 9.3 | 1.18 | * | * |
| Milking frequency | n/cow/week | 18.2 | 17.5 | 0.44 | ** | * |
| Milking interval | hh.mm. | 10.07 | 10.38 | 00.14 | ** | * |
| Milk yield | kg/cow/day | 24.1 | 23.3 | 0.55 | ** | ** |

*= $P<0.05$ **= $P<0.01$.

Concentrate intake. There was no difference between concentrate intake of FAS and C. This means that cows generally consumed all the concentrate distributed of all two treatments.

Visits to pre-selection gate. The total number of visits to pre selection gate did not show differences between treatments FAS or C.

Pre-selection gate interval. Interval between visits to the pre selection gate did not show any difference between treatments.

Visits without milking. The visits without milking were significantly higher with FAS treatment.

Milking frequency. Supply of FAS increased the milking weekly frequency. This result showed that palatability of FAS concentrate improves the attraction of cows to the AMS and the feeding area.

Milking interval. The average milking interval was significantly lower with FAS than with C treatment. Moreover, the use of the FAS concentrate reduced the number of milkings with intervals >11 hours from 31 to 26% (SE 2.6, $P<0.01$).

Milk yield. The milk yield was significantly higher with FAS. Probably, the higher milking frequency and milking with interval <11 hours had a positive effect on milk yield.

The experiment showed that cow's behaviour was modified through the use of an appetizing component of the concentrate fed in the automatic dispenser of the AMS. Cows fed FAS concentrate increased the weekly visits without milking and milking frequency and decreased milking interval. The greater milk yield of cows fed FAS could be a consequence of behaviour shift.

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