

## ASSESSMENT OF THE IMPACT OF AUTOMATIC MILKING ON THE SELECTED PARAMETERS OF DAIRY COWS WELFARE

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**Abstract:** the aim of study was to find out the influence of milking by automatic milking system (AMS) on the physiological needs of dairy cows within 30 minutes after milking. Ethological study covered the needs of feed intake, water intake and need of lying down. The need of feed intake in 30 minutes after milking was found at 75.51 % of dairy cows in the barn with AMS. The need of water intake was found at 41.79 % of dairy cows. The percentage of cows, which needed to lie down after milking, was 3.7 %.

**Keywords:** cows, milking; automatic milking system; ethological study; feed intake

### INTRODUCTION

Breeders are trying to improve the level of well-being not only in dairy cows, but also with ourselves. One of the big helpers in achieving this goal may be milking by automatic milking system - milking robot. From the perspective of farmers the most required aim is to eliminate the demanding work of milkers and to save time that can be used for other activities. The other

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reason is to reduce the number of employees, and thus financial savings, but it is necessary to calculate the increased costs of energy consumption (Upton et al., 2011), (Voříšková, 2001). The aim of study was to find out the influence of milking by automatic milking system (AMS) on the physiological needs of dairy cows within 30 minutes after milking. Ethological study covered the needs of feed intake, water intake and need of lying down. It is stated, that cattle prefer calm water surface, and therefore watering troughs are more suitable than drinkers and that cows can drink 75 - 130 litres of water depending on the type of feed ration, lactation and climatic conditions. The highest intensity of water intake – up to 40% - takes place within two hours after milking (Hofírek, 2009). Some authors state, that 41.05 % of cows need water in the period of 30 minutes after milking (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012). others state that up to 46.9 % of dairy cows (Novotná, 2012). According to other authors milking is connected with stress and virtually all of dairy cows are drinking after milking (Bensik et al., 2002), (Bensik et al., 2003), (Šoch, 2005). But all this was found during the process of milking in milking parlours, not in AMS. According to most of authors the main motivation for the feed intake is feeling hungry (Hofírek, 2009), (Voříšková, 2001), (Wagner-Storch, 2003). and the need is higher after milking (Wagner-Storch, 2003). The intensity of feed intake within 30 minutes after milking in AMS was determined by the number of dairy cows which in a given time period sought and matured a mixed feeding ration (TMR). Data from previous experiments differ about 80% (Fiala, 2011), (Novotná, 2012). While we found the difference in feed intake between heifers and cows at higher lactations which had this need higher by 13.6% (Fiala, 2011) or 9% (Novotná, 2012). It can be caused by a certain hierarchy within the herd and limited access of submissive individuals, especially younger animals to feeding table (Hofírek, 2009) (Šoch et al., 2012). After milking it is important to keep a cow on her feet for a longer time. Immediately after milking, the teat sphincter is released and the teat canal expanded, so it may be penetrated by environmental bacteria, especially when the bedding is polluted. Within an hour after milking the canal is gradually closed. The prolongation of the period of standing after milking can be influenced by the access to the feed before and after milking. To reduce the inflammation of the mammary gland it is much more important to follow the hygiene of udder before, during and after milking, which provides high-level milking robot (Fiala, 2011), (Tančín et al., 2008). While evaluating the need of lying down within 30 minutes after milking in

AMS 12.16 % of lied dairy cows were found (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012), while in heifers the need of lying down was by 1 % higher (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012). The observed difference between heifers and older cows was minimal. Lying down is to a certain extent related with ruminating, which begins approximately 15-17 minutes after finishing the feed intake and it is associated with high energy consumption, when cows are usually lying on their side (Bencsik et al., 2002), (Bencsik et al., 2003), (Šoch, 2005).

## **MATERIALS AND METHODS**

Experiments were carried out on a farm with free stabling with 61 dairy cows, 38 heifers and 15 calves under 6 months of age. All animals were of Holstein breed, the average annual yield per cow moved around 12,000 litres of milk in the long-term.

AMS (automatic milking system) of company Lely has been in operation since 18.09.2007 at the farm. The main reasons for the acquisition were for the owner the comfort of family and time saving. Feeding in the stable is provided by a mixing and feeding car and takes place once a day always around 6 p.m. The composition of feed ration is regulated according to individual groups of animals and lactating cows are in the robot also given a dose of a mixture according to their performance in the range of 1-8 kg (0.4 kg / litre of milk). Ration in the milking robot is used both to increase production and quality of milk, and to increase motivation of dairy cows to visit the robot. Watering is provided by watering troughs. In the frame of the survey of physiological needs we conducted three 24hours ethological observations on the farm where cows are milked by AMS (automatic milking system). Overall, physiological needs of 457 pieces of cows within 30 minutes after milking were tested on this farm. For each cow a need of water intake, feed intake and need to lie down were monitored. Using the computer program Lely T4C data on milk yield, duration of milking and frequency of visits were obtained. To process the information we used Microsoft Excel. Differences in the frequency of monitored groups of heifers and other cows in case of need of feed intake, water intake or need to lie down were compared using the  $\chi^2$  test. Comparison of commercial properties of groups of heifers and other cows were performed using Students t-test in programme Statistika.

## RESULTS AND DISCUSSIONS

Altogether 457 observations of cows during 30 minutes after leaving the robot were carried out in the experiment. From this total number, there were 150 heifers and 307 cows on the other lactations.

### a) Feed intake

Feed intake (Table 1) was found at 75.71 % of monitored dairy cows, 68 % of heifers and 79.45 % of other dairy cows. In comparison with data of other (Fiala, 2011), (Novotná, 2012), (Šoch et al., 2012), who state in their studies the total feed intake at 81.8 % and 80.8 %, our figures observed are lower by 6 %, respect. by 5 %. This difference can be due to a slight change in a feed ration. Furthermore there is an obvious higher feed intake of dairy cows on other lactations compared with heifers by 11.45 %.

In published studies (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012) this difference is 13.6 %, alternatively 9 % (Novotná, 2012). Figures recorded in this experiment do not differ considerably very much from the former observations. This difference can be explained in accordance with the reported findings (Šoch et al., 2005) by a higher total performance of cows on other lactations and therefore a possible higher issue of energy during milking. Another reason may be the dominant position of older cows in the herd, which usually spend more time at the trough and according to some authors (Hofírek, 2011), (Šoch, 2005), (Šoch et al., 2012) they prevent by this way to access of submissive individuals. Automatic milking system Lely offers cows a dose of grain mixtures, whose amount depends on the performance of a given cow. This way dairy cows accept the feed also during milking. Despite this fact, most dairy cows observed in the experiment aimed after leaving the AMS to the feeding table with a mixed feeding ration (TMR).b)

Table 1. Feed intake within 30 minutes after milking in specific parts of the day.

Time period	1.observation (98 feedings)	2.observation (122 feedings)	3. observation (126 feedings)	average
0:00-6:00	22.45 %	25.60 %	20.63 %	22.56 %
6:00-12:00	19.39 %	19.67 %	19.05 %	19.37 %
12:00-18:00	23.47 %	23.77 %	23.02 %	23.42%
18:00-0:00	34.69 %	31.97 %	32.54 %	33.07 %

### b) Water intake

Need of water intake was found at 41.79 % of the whole number of dairy cows, 38.66 % of heifers and 43.32 % of other dairy cows. Other authors (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012) state the total need of water within 30 minutes after milking 41.05 % of cows, respect. 46.9 % (Novotná, 2012). Again, a higher water intake in older cows, about 4.66 % is obvious. This difference is not too high and can be related with a higher performance in older dairy cows (Bencsik et al., 2002), (Bencsik et al., 2003), (Šoch, 2005). In some publications the difference only 1.3 % is quoted (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012), other authors, however, state the reverse difference, namely a higher water intake in heifers, about 15 % (Novotná, 2012).

Table 2. Water intake within 30 minutes after milking in specific parts of the day.

Time period	1. observation (60 drinkings)	2. observation (58 drinkings)	3. observation (73 drinkings)	average
0:00-6:00	18.33 %	15.52 %	17.8 %	16.76 %
6:00-12:00	30 %	37.93 %	34.24 %	32 %
12:00-18:00	30 %	17.24 %	30.14 %	25 %
18:00-0:00	21.67 %	29.31 %	17.81 %	22.93 %

### c) Need to lie down

Lying down after milking of dairy cows was observed overall in 3.7 % of the total number of dairy cows, 5.3 % of heifers and 2.9 % of other cows. In the literature (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012) totally 12.16 % of lied cows is quoted; our recorded figures are by 8 % lower. The observed difference between heifers and older cows is 2.4 %; the difference is in this number minimal, although some authors say this difference is even lower (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012).

Total number of observed physiological needs within 30 minutes after milking is shown in the following Table 4. Most of the dairy cows (75.1 %) aim after milking to the feeding table with mixed feeding ration (TMR) and less than half of them (41.79%) feel the need of water intake and it is despite the fact that the waterhole is located at the exit of the milking robot.

Difference between feed and water intake was 34.31 % and similar differences state also other quoted authors (Fiala, 2011), (Novotná, 2012), (Šoch et al., 2011), (Šoch et al., 2012), (Wagner-Storch, 2003), which does

not correspond with the findings of the behaviour of dairy cows milked in milking parlours (Bencsik et al., 2002), (Bencsik et al., 2002), (Šoch, 2005), (Šoch et al., 2012), (Tančin et al., 2008). From the total number of 457 observations common feed and water intake within 30 minutes after milking was found in 129 cases, which is 28.23% of the total. In 111 cases, i.e. 88.6 % of dairy cows, felt need of water intake earlier. In the literature (Fiala, 2011), (Šoch et al., 2011), (Šoch et al., 2012) 23.63 % of common intake is quoted, it means a similar result. 5.03 % of cows did not feel any need of feed or water intake. Common intake of feed and water and lying down were observed only in 3 cases, lying down and feed intake together only one time and common lying down and drinking in 4 cases.

Table 3. Need to lie down within 30 minutes after milking in specific parts of the day.

Time period	1. observation (6 lyings down)	2. observation (5 lyings down)	3. observation (6 lyings down)	Average
0:00-6:00	50 %	40 %	66.67 %	52 %
6:00-12:00	16.67 %	20 %	0 %	12.22 %
12:00-18:00	16.67 %	0 %	0 %	5.56 %
18:00-0:00	33.33 %	40 %	33.33 %	35.55 %

Table 4. Total number of physiological needs within 30 minutes after milking.

	Feed intake	Water intake	Lying down
Total number of cows	346 (75.71 %)	191 (41.79 %)	17 (3.7 %)
Heifers	102 (68 %)	58 (38.66 %)	8 (5.3 %)
Other cows	244 (79.45 %)	133 (42.32 %)	9 (2.9 %)

## CONCLUSIONS

Influence of milking with an automatic milking system on physiological needs of cows within 30 minutes after milking was determined in a herd of highly performed dairy cows of Holstein breed and at the same time the influence of the age (heifers and older cows) on observed behavioural manifestations was assessed. Feed intake was found in the given observed time period at 75.71 % of the total number of observed dairy cows, 68 % of heifers and 79.45 % of other dairy cows. Need of feed intake after milking

was higher in older cows, by 11.5 % and according to the performed test it was statistically highly significant ( $p < 0.05$ ). This difference can be explained by higher performance of cows on other lactations and therefore a possible higher issue of energy during milking. Need of water income was found at 41.79 % of the total number of dairy cows, 38.66 % of heifers and 43.32 % of other dairy cows. The difference was not statistically significant and it can be also related with higher performance of older cows. Lying down after milking was observed at 3.7 % of total number of dairy cows, 5.3 % of heifers and 2.9 % of older cows. This difference is found as statistically highly significant ( $p < 0.05$ ). It can be explained by a possible higher degree of fatigue and level of stress in heifers after milking. The highest need of feed income was in the daytime between 6 a.m. and midnight, while the lowest one in the morning till noon. The highest need of water income after milking was in the morning between 6 and 12 p.m. and the lowest in the night from midnight till 6 p.m. The highest need of lying down after milking was in the night from 0 till 6 p.m. and the lowest between 12 and 18 a.m. From the perspective of welfare using of automated milking system strengthens the freedom of cows to express their standard behaviour and freedom from fear and depression (anxiety), by allowing free choice of accession to milking.

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