EVALUATION OF COWS MILKING PROCESS IN HERRINGBONE AND ROTARY MILKING PARLOURS

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Abstract. The aim of our studies was to compare evaluation parameters of milking when cows were milked in rotary (carousel) and herringbone milking parlours. The tasks were to evaluate and analyze the process of milking in both parlours. The time spent on premilking treatment of teats was recorded. The data associated with milking process were taken from the "Afimilk" database of computerised herd management system *„SAE-Afikim"* (*Israel*). We analysed the data of cow milking parameters (milk flow rate 0–15, 15–30, 30–60, and 60–120 seconds after cluster attachment, milking time, yield, etc.). The duration of the delay between the beginning of udder preparation and attachment of clusters was long and this affected milking time significantly in both milking parlours ($p<0.001$). Too short udder preparation for milking in both parlours (particularly in the rotary parlour) could affect slow milk removal. After attachment of cups, milk flow in the herringbone parlour appeared in about 8 seconds and in the rotary parlour in about 13.6 seconds ($p<0.001$). During the first two minutes, milk flow rate (kg/min) in different periods was statistically significantly higher ($p<0.05$) in herringbone milking parlour. Milk flow rate (kg/min) was too high when clusters were removed from teats in rotary and in herringbone parlours. These all processes were influenced by poor udder preparation before milking.

Keywords: cow, milking, herringbone, rotary, parlour.

Introduction. Milking efficiency is a combination of proficiency of the milker, operation of the milking equipment and individual traits of cows. Many factors influence overall milking efficiency and dairy performance, including operators' work routines, size of the dairy and the time it takes to milk the cows (Mein *et al.,* 2007). One of the most important factors affecting the quality and quantity of milk and mastitis prevention are milking procedures (Fuhrmann, 2002). The genetic factor has the greatest impact on dairy cow milk flow; however cow teats' premilking procedures also are an important factor (Johnson, 2006). In one study, cows that received 31 s of premilking stimulation and had a consistent time interval (1.22 ± 0.25 min) between stimulation and unit attachment produced a higher yield compared to the cows that received a variable milking routine (Hogeveen *et al.,* 2001). The amount of stimulation required for effective milk ejection is affected by breed, stage of lactation, and production level. To maximise machine on-time, monitoring milk flow curve can be an important management tool in improving the milking routine. Accurate labour organisation planning data are of supreme importance to modern dairy farms with up-to-date milking parlour procedures. They make the targeted identification and use of existing rationalisation potential possible. In group milking parlours (herringbone and side-by-side milking parlours) rational completion of routine jobs is used, but it also means that the group can only be let out when the last cow in the group has been milked dry. In individual milking parlours (rotary-carousel, autotandem milking parlours) each cow is milked individually. This means that the waiting times are very low. Of course the smooth circulation of cows is a basic requirement here. This means that, if it isat all possible, the cows enter the milking parlour independently, without herding (Ginsberg *et al,* 2010).

Optimal premilking cow preparation has been proven to be an important step in achieving maximum milking speed, milk yield and quality without compromising gentle and complete milking (Johnson 2006; Mein and Reinemann, 2007; Reid, 2008). The objective of our research was to compare milking process in herringbone and rotary milking parlours used on the same farm.

Material and methods. The data were collected from March to June, 2010, in a Joint-Stock Company. Investigations were carried out with 900 Lithuanian White-and-Black milking cows. Milk yield per year was about 5200 kg/cow in 2009. The herd of cows was based on 1–3 lactation cows. Cows were milked twice a day. The milking equipments were operated by the AFIMILK system (S.A.E. AFIKIM, Israel), which collects and checks all the data coming from the milking parlours, including the milking position of each cow and the time and duration of milking. Cows were milked in the milking parlours of two types: rotary with 28 standing places and herringbone milking parlour (2x14). In herringbone parlour an average of 522 and in rotary 378 cows were milked. Procedures of cows' preparation before milking in both parlours consisted of manual operations: forestripping and cleaning and drying with a dry paper towel. Udder preparation time (from touching the udder before clusters were attached) was fixed with chronometer during control milking. The milking system

was provided with the automatic cluster detachment mechanism. We eliminated individual characteristics of cows such as milk yield, stage and age. The main focus was on milk flow during milking 0–15, 15–30, 30–60, and 60–120 seconds from the start of cluster attachment. Low milk flow was classified as less than 1 kg/cow/minute. Data of milk flow rate were taken from the database of the above mentioned milking herd management program.

Other parameter monitored was duration of the delay between the beginning of teats' preparation and clusters attachment. Statistical analysis was performed with Descriptive Statistics and Independent-Samples T test procedures in SPSS 13.0 for Windows. The means and standard errors of traits for each group were calculated. The difference was considered to be statistically significant when $p<0.05$.

Results and Discussion. Proper udder preparation, including forestripping and predipping, resulted in better milking performances compared with poor preparation: greater milk yield per milking, shorter milking time, and lesser bimodality. The lag of time from the start of stimulation until the onset of milk ejection is 1 to 2 min depending on the degree of udder filling (Bruckmaier *et al.,* 2001; Bruckmaier *et al.,* 1995).

Fig. 1 shows mean values for premilking cow teats procedures (forestripping, cleaning and drying), unit attachment and the beginning of milk flow. The time taken for cow premilking preparation in herringbone parlour was on average almost twice as short as in the rotary parlour (respectively 12.41 s and 22.71 s). After attachment of cups, milk flow in the herringbone parlour appeared in about 8 seconds and in the rotary parlour in about 13.6 seconds ($p<0.001$). The period between stimulation and unit attachment, and the consistency and duration of udder preparation are critical factors for milking efficiency (Hogeveen *et al., 2001*). Sandrucii *et al.* (2007) evaluated that premilking delay time, between the start of teat stimulation and clusters attachment affected milking time significantly. As reviewed by Rasmussen (2005), the maximum benefit of premilking stimulation will be achieved if clusters are attached after teat preparation but allowing enough time for the milk ejection response to reach its peak. Hogeveen *et al.* (2001) suggested an optimal prestimulation of 20 to 30 s associated with a delay of attachment.

Studies of milk flow during milking provide useful information for enhancing the efficiency of milking process and protecting udder health. The descriptive statistics of different parameters of milking efficiency in herringbone and rotary milking parlours are given in Table 2. This table shows the main indexes of the milking process. Milk yield per milking of cows milked in herringbone parlour was on average by 0.52 kg lower but milk yield during the first two minutes was by 0.75 kg higher than in the rotary milking parlour. The total milk yield during the first two minutes was by 11.76 percent hither in herringbone milking parlour. This difference resulted in shorter udder preparation in the rotary parlour. In herringbone milking parlor, the preparation of teats began when one half of the milking parlour was completely filled with cows while in the rotary milking site cow preparation for milking begins immediately. The milk flow rates at 0–15, 15–30, 30–60, and 60–120 s were respectively 0.09, 0.23, 0.46 and 0.49 kg/min higher in the herringbone milking parlour. The initial milk flow level was significantly related with milk letdown on consecutive milking stages. Cows with low milk flow (<1 kg/h) during the first 15 sec after cluster attachment, have higher milking time, a relatively low flow during the first two minutes of milking, low peak flow and longer time to reach it than cows that have a high flow rate (>1 kg/min), when compared for similar yield per milking. It can be suggested that initial milk flow may serve as valuable predictor of cow's milkability (Weiss *et al*, 2003; Livishin *et al*., 2005).

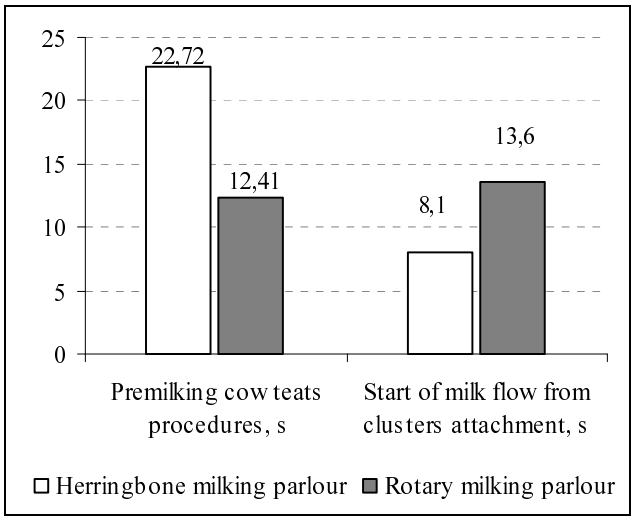

Fig. 1. **Mean values for premilking cow preparation and the start of milk flow in herringbone and rotary milking parlours**

Table 2. **Evaluation of milking flow rate**

Milking index	Parlour type	
	Herringbone	Rotary
Yield kg	7.58±0.09	8.1±0.11
Milk 2 min kg	3.47±0.055***	2.72±0.055
Milk % 2 min	47.64±0.596***	35.88±0.596
Low flow time min	2.08±0.035***	2.78±0.086
Flow rate 0–15 s	0.16±0.012*	0.07±0.039
Flow rate 15–30 s	1.29±0.034***	1.06±0.074
Flow rate 30–60 s	1.49±0.036***	1.03±0.03
Flow rate 60–120 s	2.35±0.036***	1.86±0.035

*** $p<0.001$; * $p<0.05$

Average milk flow rate is a good indicator of the efficiency of milking. Low average milk flow rates or longer milking times can result from interference with the letdown responce due to uneasiness of the cows, inadequate cow stimulation, improper timing of unit attachment in relation to milk letdown, milking machine

problems or overmilking, because of the improper detachment procedures. Premilking teat stimulation from 10 to 20 s and an interval of 60 to 90 s between stimulation and unit attachment are generally considered adequate to achieve efficient milk letdown and removal (Reneau *et al.* 1995).

Comparison of the preparation of cow teats for milking in both parlours shows a significant difference in milk yield during the first fifteen seconds of milk flow and low flow time (Table 2). The time of low milk flow when cows were milked in herringbone parlor was shorter. Comparing milking in both parlours according to milk yield during 0–15 s it can be concluded that poor udder preparation before milking in rotary parlour triggered a long low flow time of milk (it was by 0.7 min longer compared to the time in herringbone parlour). Poor udder preparation had a negative effect on milk releasing.

According to the total milk yield of cows, the milking time in both parlours was long (Table 3). Duration of the delay between the beginning of udder preparation and cup attachment affected milking time significantly in both milking parlours. Milk flow rate (kg/min) at the time when clusters were removed in rotary and in herringbone parlours was high. It was 0.7 kg/min higher in rotary milking parlour. Evaluating milking parlour performance can be beneficial to improve milking quality and quantity and our study only confirmed that the main factor affecting milk yield and milking flow rate parameters is proper cow udder preparation before milking.

Our results are in accordance with Weiss *et al.* (2003) who also found proper prestimulation to be essential to obtain continuous and rapid milk removal (Bruckmaier *et al.* 2005).

Table 3. **Automatic detachment milking machine**

	Parlour type	
	Herringbone	Rotary
Milking time, min	6.85±0.306*	8.03±0.378*
Milk flow rate (kg/min) when clusters were removed	0.89±0.129	0.96±0.18

* $p<0.05$

Premilking delay time, between the start of teat stimulation and clusters attachment, affected milking time significantly.

Conclusions

1. Preparation of udder took 10.3 s longer in the herringbone milking parlour.

2. During the first two minutes, 0.75 kg more milk was milked in the herringbone than in the rotary milking parlour ($p<0.001$).

3. During the first two minutes, the milk flow rate in different periods was statistically significantly higher ($p<0.05$) in the herringbone milking parlour.

4. Anyhow better milking process with greater milk yield and shorter milking time depends from proper udder preparation comparing with poor udder preparation,

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