Slovak J. Anim. Sci., 43, 2010 (3): 128 - 133
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ISSN 1337-9984

MILKABILITY OF THE IMPROVED VALACHIAN EWES DURING MACHINE MILKING

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ABSTRACT

The objective of this study was to evaluate the reaction of Improved Valachian ewes to machine milking and also to assess their milking characteristics. Bimodality is one of the most important indicators of milk ejection reflex during milking without the udder stimulation. The milk ejection reflex is an essential component for complete milk removal during milking. The trial was performed with 107 Improved Valachian ewes. Ewes were milked twice daily for two consecutive days in April at rotary milking machine with 36 milking stalls. The equipment for graduated electronic milk recording in jar was used. A computer was used for recording the level of milk in jar at the second intervals. A total of 83 milk flow curves were evaluated. These curves were classified into five groups: 1 peak (1P), 2 peaks, bimodal curves (2P), plateau I (PLI, peak flow over 0.4 l/min), plateau II (PLII, peak flow less than 0.4 l/min) and additional milk flow PL with bimodality (PLB). The ratio of different curve types (1P:2P:PLI:PLII:PLB) was 27:51:11:6:5%. The highest milk production was found in ewes with PLI (0.767 ± 0.053 l) as compared with PLB (0.497 ± 0.079 l), 2P (0.433 ± 0.024 l), 1P (0.250 ± 0.033 l) and the lowest milk production was measured in ewes with PLII (0.237 ± 0.070 l). Obtained results indicate relatively high percentage of 1P milk flow pattern but more measurements is required to specify the ability of Improved Valachian to machine milking.

Key words: dairy ewes; milk flow curves; milking characteristics; milk ejection; bimodality

INTRODUCTION

Improved Valachian (IV) and Tsigai (TS) represent Slovak sheep with high endurance and adaptability to walking and natural conditions (Oravcová et al., 2002). They are often crossed with Lacaune (LC) or purebred selection through the genetic evaluation done with the purpose of improving their milk production and milkability (Oravcová and Peškovičová, 2008). The machine milking of IV and TS in Slovakia already started during 1960s. Introduction of milking machines required information related to the milkability of ewes and search for the best milking parameters. Therefore many experiments were carried out concerning milkability of the mentioned breeds in Slovakia during 1960s till 1980s (Mikuš, 1973) in cooperation with France (Labussičre, 1988). However, machine technology did not spread to farms in a larger scale from that time in Slovakia.

To improve the milkability of ewes in Slovakia and their milk production it is necessary to increase the knowledge of physiological response to machine milking. Some useful parameters to evaluate milkability are obtained by the measurement of the kinetics of milk flow rate (Bruckmaier et al., 1997; Marnet and McKusick, 2001; Dzidic et al., 2004). Milk flow kinetics is related to milk production (Rovai et al., 2002; Villagrá

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Received: March 20, 2010
Accepted: June 15, 2010

et al., 2007) especially in non-well genetically selected breeds (Mačuhová et al., 2008), where it can indicate the occurrence of milk ejection reflex, which is crucial for complete milk removal and thus for milk production (Tančin and Bruckmaier, 2001).

Milk within the udder of dairy ruminants can be divided into two fractions: the cisternal fraction, which has already been transferred from the alveoli to the cistern during the intermilking interval and is immediately obtainable without milk ejection, and the alveolar fraction, which can be removed from the udder only if milk ejection occurs during machine milking (Tančin and Bruckmaier, 2001). Large differences between dairy species exist with respect to the proportion of total milk that can be stored within the cistern. For example, following a normal milking interval of 12 to 14 h, the dairy ewe and goat can store up to 75% of the total milk volume within the cistern (Marnet and McKusick, 2001).

There are only limited measurements of milk flow kinetics in IV breed and its physiological response to machine milking are scanty in literature (Mačuhová et al., 2007, 2008, 2009; Margetín et al., 2005; Tančin et al., 2009). The objective of this study was to evaluate the reaction of Improved Valachian ewes to machine milking and also to assess their milking characteristics.

MATERIAL AND METHODS

Animals

The experiment was carried out at the NOFA farm in Vrbov, Slovakia in April. A total of 83 dairy ewes of IV breed were randomly selected during milking for experimental measurements from the pedigree flock of 1200 dairy sheep. The animals were kept on the pasture and only at milking time they were brought into the rotary milking parlour (38 kPa, 50:50, 160 cycles/min). During milking each sheep received concentrate. Ewes were routinely milked twice daily in a rotary milking machine, with 36 milking stalls.

Milk flow curves

Milk flow curves were evaluated according to Bruckmaier et al. (1997) and Rovai et al. (2002) into four types [1 peak (1P), 2 peaks (2P), plateau I (PLI), plateau II (PLII) and also additional milk flow curves plateau with bimodality (PLB)]. The first type 1P represents milk flow curves with one peak of milk flow before stripping. The 2P type of milk flow has two clearly separated milk flow peaks with decreasing milk flow of first emission to 0 l/min before second emission started. The PLI represents milk flow by ewes with larger emission curves and maximal milk flow rate > 0.4 l/min without clear differences between peaks 1 and 2 (Figure 1). Plateau II

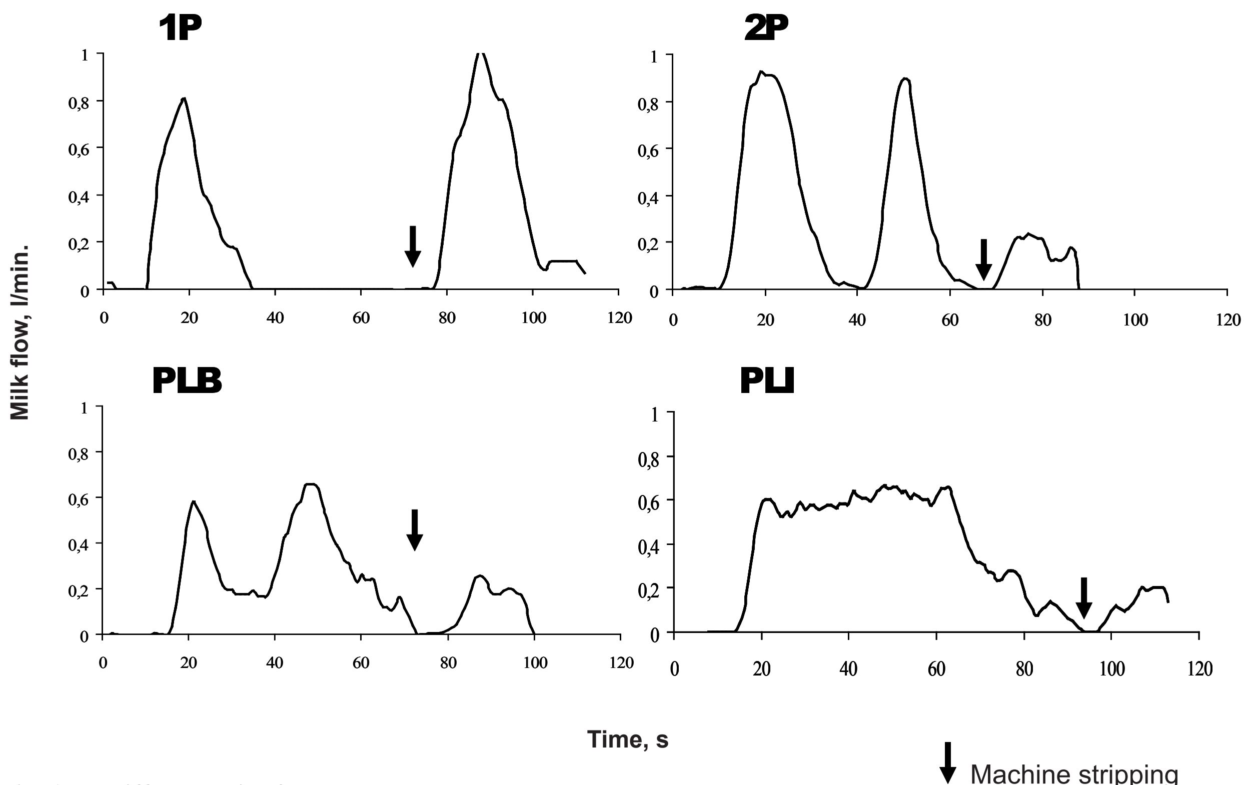

Fig. 1: Different milk flow types

(PLII) represents milk flow curves with steady milk flow during milking, but at very low milk flow level (maximal milk flow rate ≤ 0.4 l/min). Additional milk flow curve was the curve with steady milk flow and two peaks but between 1st and 2nd peak milk flow didn't drop on the level 0.l/min (PLB).

Milk flow was continuously recorded by graduated electronic milk collection jar for ewe milking. Milk flow kinetics was recorded individually using four electronic jars (1.5 l each) collecting total milk produced at the milking. Within each jar there was a 2-wire compact magnetostrictive level transmitter (NIVOTRACK,NIVELCO Ipari Elektronika Rt, Budapest, Hungary) connected with the computer. Milk level in the jar was continuously measured by a transmitter recording signals on the computer every second. Using four jars it was possible to milk out four ewes at the same time.

Milk flow data were calculated using the following formula:

Milk flow rate (l/min) = $(L_n - L_{n-4}) \times 15$

L – milk yield in litres,

n – time in s, n > 3 s.

During experimental measurements the clusters were attached immediately without any udder stimulation or pre-dipping and kept on teats for 70 s since the attachment, even though no milk flow was detected (no increment of milk level in the jar), or longer if milk level in the jar slightly increased. Afterwards, the machine stripping was performed with hand massage of the udder before the teat cup removal. The time of 70 s was expected to be sufficient to record the second emission of milk release when milk ejection occurred.

The following milking characteristics were evaluated: machine milk yield (MMY -the amount of milk obtained by the machine from time 0 to the time when the milk flow ceased), machine stripping (MS - the amount of milk obtained by the milker during machine stripping), machine stripping percentage (MS% - percentage of machine stripping from total milk yield (TMY - machine milk yield + machine stripping), maximal milk flow rate (MMF - the maximum flow rate recorded during machine milking for a period of at least 3 s.), milk flow latency (MFL - the lag time between the attachment of teat cups and reaching of 0.03 l in jar), milking time (MT – time from cluster attachment until milk flow ceased) and milk yield in 60 s (MY60 - the amount of milk obtained in 60 s). Milk yield in 60 s was the same as machine milk yield if the time of milking was less than 60 s. In bimodal curves the time when the second emission started (BT) was also recorded.

STATISTICAL ANALYSIS

The data set consisted of 83 measurements belonging to 83 ewes. GLM (General linear model SAS/ 8.2 (2002) was applied to study the influence of the sources of variation in studied traits (milk emission/milkability). Statistical significance was tested by Fischer's F-test and differences between the estimated levels of fixed effect were tested by Scheffe's multiple range tests.

RESULTS

The frequency of different milk flow types represented 27 %, 51 %, 11 %, 6 % and 5 % for 1P, 2P,

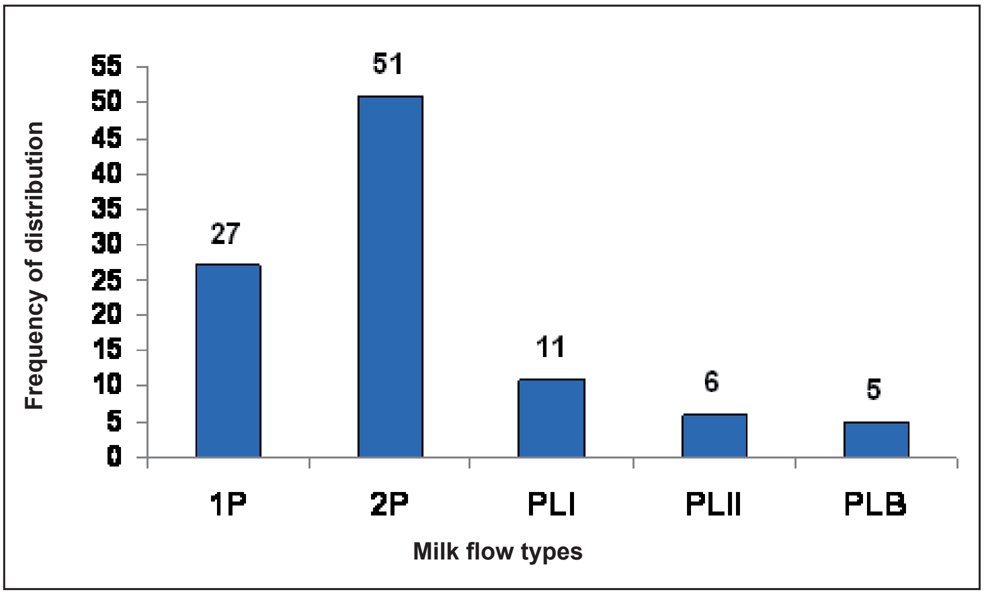

Fig. 2: Frequency of distribution (%) of milk flow types

Table 1: Basic statistical characteristics

Trait	No. of ewes	Minimum	Maximum	Mean	Standard Error
Total milk yield (l)	83	0.083	1.232	0.410	0.024
Machine stripping (l)	83	0.055	1.174	0.336	0.023
Machine stripping %	83	0	75.15	20.92	1.78
Milking time (s)	83	19	173	59	2.62
Max. milk flow(l/min)	83	0.210	3.105	1.228	0.064
Bimodality time (s)	42	20	62	44,93	8.23

PLI, PLII and PLB, respectively. These frequencies are shown in Figure 2. The highest occurrence was observed in 2P milk flow curves and the lowest in PLII and PLB. Fifty five percent of the milk flow curves were considered suitable because ewes with 2P, PLI and PLB milk flow types respond well to machine milking and they are also characterized by higher total and machine milk yield than ewes with PLII and 1P milk flow curves.

Basic statistical data are shown in Table 1. Significant individual variability was observed in measured milking characteristics and milk production parameters. Total milk yield, machine stripping, machine stripping percentage, milking time, maximal milk flow and bimodality are considered to be important characteristics, as shown in Table 2. The highest TMY and MMY were observed in ewes with PLI milk flow type followed by PLB, then 2P, and milk flow types with the lowest TMY and MMY were in ewes with PLI and 1P. Ewes with 2P, PLI and PLB milk flow were characterized by lower MS percentage from TMY compared to ewes with 1P, PLII milk flow.

Table 2: The effect of milk flow type on milkability

Trait		Milk flow type					Significance level
		2P	1P	PLI	PLB	PLII	
TMY (l)	$\bar{x}$	0.433	0.250	0.767	0.497	0.237	2P:PLI,1P:PLI,PLI:PLII ^{xxx}; 2P:1P ^{xx}
	$s_{\bar{x}}$	0.024	0.033	0.053	0.079	0.070	
MMY (l)	$\bar{x}$	0.372	0.168	0.649	0.446	0.147	2P:1P,1P:PLI,PLI:PLII ^{xxx}; 2P:PLI ^{xx} 2P:PLI ^{x}
	$s_{\bar{x}}$	0.024	0.032	0.051	0.077	0.069	
MS% (%)	$\bar{x}$	15.23	31.79	16.25	10.30	35.61	2P:1P ^{xx}
	$s_{\bar{x}}$	2.185	2.953	4.721	7.081	6.334	
MT (s)	$\bar{x}$	69	40	67	52	51	2P:1P ^{xxx},1P:PLI ^{x}
	$s_{\bar{x}}$	3.16	4.274	6.833	10.249	9.167	
MMF (l/min.)	$\bar{x}$	1.409	1.063	1.247	1.220	0.445	2P:1PLII ^{xx}
	$s_{\bar{x}}$	0.083	0112	0.179	0.269	0.241	
MY60 (l)	$\bar{x}$	0.329	0.156	0.583	0.431	0.124	2P:1P,2P:PLI,1P:PLI,1P:PLB PLI:PLII ^{xxx},PLB:PLI ^{x}
	$s_{\bar{x}}$	0.022	0.030	0.048	0.072	0.064	

Significance level – F- test, $P<0.05$ ^{x}, $P<0.01^{xx}$, $P<0.001$ ^{xxx}, $\bar{x}$ - mean , s_x – standard deviation

TMY- total milk yield, MMY- machine milk yield, MS% - machine stripping percentage, MT- milking time, MMF- maximum milk flow, MY60- milk flow in 60 s

DISCUSSION

Milk production of IV ewes was similar in comparison to earlier studies (Masár, 1974), but also to recent studies (Oravcová et al., 2005; Mačuhová 2007, 2008). Share of the milk obtained by machine milking (MMY) without milk obtained by machine stripping (MS) to the total milk yield (TMY) is an important indicator in machine milking process. Percentage of machine stripping was 21 %, which means that percentage of MMY was 79 % and these results agree with those recorded by Margetín et al. (2005) and Mačuhová et al. (2008) for IV ewes. Also, other parameters of milkability found in IV under practical conditions were similar to those published for IV under experimental conditions (Mačuhová et al., 2008).

Relatively higher occurrence of bimodal and PLI milk flow curves was observed in this study. These types of milk flow patterns are very important. They reflect better adapted animals to machine milking, because it is assumed that they achieve milk ejection during milking. Ewes with 2P and PLI milk flow are characterized by lower MS percentage from TMY compared to ewes with 1P milk flow. In this study a significant difference in TMY and MMY was found between groups of ewes without bimodality and ewes with PLI milk flow. Similar results were also published also earlier (Rovai et. al, 2002; Villagrá et al., 2007). The ratio of frequency distribution of five types of milk flow curves evaluated in this study agrees with previous reports by Mačuhová et al. (2007). Recently, Mačuhová et al. (2009) noted that the percentage of 1P milk flows in IV reached higher values (35 %). The second least frequency of occurrence was observed in PLII type of milk flow. This type of milk flow curve was seldom observed in other breeds, too (Dzidic et al., 2004). Extremely weak or totally absent oxytocin release during milking is typical for dairy sheep with PLII type of milk flow curves (Bruckmaier et al., 1997).

The fact that the ewes with PLI type of milk flow had the highest total milk yield (0.767 ml) and the lowest machine stripping percentage (16 %) from evaluated types of milk flow curves, supports the assumption that in this type of milk flow the milk ejection reflex could really occur, though the cisternal and alveolar fractions were not clearly visible as in 2P type of milk flow. Such ewes (PLI) could have a milk ejection but second emission is masked probably due to filling of cistern by alveolar milk before milk from cistern is removed (Marnet et al., 1998) perhaps as a result of high milk production and lower MMF rate as compared to 2P. Similar results were published in our earlier work (Mačuhová et al., 2008). Obtained results indicate relatively high percentage of 1P milk flow pattern but more measurements is required to specify the ability of Improved Valachian to machine milking.

ACKNOWLEDGMENT

This publication was prepared as a part of realization of the project“ LAGEZ no.26220120051“ supported by the Operational Programme for Research and Development from the European Regional Development Fund“ and Grant Agency VEGA foundation of the Ministry of Education of the Slovak Republic (Project No. 1/0695/09).

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