MILKABILITY IN HOLSTEIN COWS
DOJITEĽNOSŤ KRÁV HOLŠTAJNSKÉHO PLEMENA

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ABSTRACT

The aim of this work was evaluation of milkability in Holstein cows. We collected a total 63 milk flow curves, using electronic mobile milk flow meter – lactocorder. The measuring was carried out in cows from 5 to 305 days in milk. The average milk yield per milking was 15.63 kg, with average milk flow rate 2.84 kg.min^{-1} and average maximum milk flow rate of 4.49 kg.min^{-1}. The average duration of incline phase was 1.09 min., duration of plateau phase was 1.82. min, and duration of decline phase was 2.26 min. Percentage of bimodal milk flow curves was 52 %, on average. The highest average milk flow rate (3.01 kg.min^{-1}) and the highest average peak milk flow rate (4.96 kg.min^{-1}) were found in cows in second lactation, in comparison with primiparous cows (2.87 kg.min^{-1}, and 4.37 kg.min^{-1}) and cows in another lactation (2.7 kg.min^{-1}, and 4.3 kg.min^{-1}).

Key words: lactocorder, milking process, milkability, milk flow rate, dairy cows

ABSTRAKT

V práci sme hodnotili dojiteľnosť kráv holštajnského plemena. S pomocou prístroja lactocorder sme analyzovali celkom 63 kriviek prietoku mlieka. Hodnotenie bolo vykonané v časovom období od 5. do 305. dňa laktácie. Na základe uskutočnenej analýzy sme v hodnotenej populácii kráv zistili priemerný minútový výdojok 2,84 kg.min^{-1} a priemernú maximálnu rýchlosť toku mlieka pri dojení 4,49 kg.min^{-1}, pri produkcii 15,63 kg mlieka pri dojení. Na základe našich meraní a podrobnej časovej analýzy priebehu dojenia sme zistili priemernú dĺžku vzostupnej fázy 1,09 min., vyrovnanej (plató) fázy 1,82 min a fáza poklesu toku mlieka – zostupná fáza predstavovala 2,26 min. Bimodalita hodnotených kráv dosiahla priemernú úroveň 52 %. Najvyšší priemerný minútový výdoj (3,01 kg.min^{-1}) a najvyšší priemerný maximálny minútový výdoj (4,96 kg.min^{-1}) sme zaznamenali pri kravách na druhej laktácii, v porovnaní s prvôstkami (2.87 kg.min^{-1}, resp. 4.37 kg.min^{-1}) a kravami na tretích a ďalších laktáciách (2.7 kg.min^{-1}, resp. 4.3 kg.min^{-1}).

Kľúčové slová: lactocorder, priebeh dojenia, dojiteľnosť, prietok mlieka, kravy

DETAILED ABSTRACT

S použitím prístroja lactocorder sme hodnotili dojiteľnosť a priebeh dojenia kráv holštajnského plemena. Celkom bolo analyzovaných 63 kriviek prietoku mlieka. Hodnotenie bolo vykonané v časovom období od 5. do 305. dňa laktácie. Kravy boli dojené dva krát denne. Na základe uskutočnenej analýzy sme v hodnotenej populácii kráv zistili priemerný minútový výdojok 2,84 kg.min^{-1} a priemernú maximálnu rýchlosť toku mlieka pri dojení 4,49 kg.min^{-1}, pri produkcii 15,63 kg mlieka na výdoj. Prístroj lactocorder analyzuje rýchlosť toku mlieka len z hlavnej fázy dojenia (t.j. po prekročení rýchlosti toku mlieka nad 0,5 kg.min^{-1}). Z hľadiska toku mlieka môžeme hlavnú fázu dojenia rozdeliť na fázu vzostupnú, vyrovnanú (plató) fázu a fázu poklesu toku mlieka. Na základe našich meraní a podrobnej časovej analýzy priebehu dojenia sme zistili priemernú dĺžku vzostupnej fázy 1,09 min., vyrovnanej (plató) fázy 1,82 min. a fáza poklesu toku mlieka – zostupná fáza predstavovala v priemere 2,26 min.

Pri zohľadnení vplyvu poradia laktácie sme zistili najvyšší priemerný minútový výdoj (3,01 kg.min^{-1}) a najvyšší priemerný maximálny minútový výdoj (4,96 kg.min^{-1}) pri kravách na druhej laktácii. V porovnaní s kravami na prvej laktácii, resp. staršími kravami (na tretej a ďalších laktáciách) to predstavuje vyššie hodnoty o + 0,14 kg.min^{-1} a + 0,59 kg.min^{-1}, resp. +0,31 kg.min^{-1} a +0,66 kg.min^{-1} pri priemernom maximálnom prietoku mlieka pri dojení. Najdlhšie trvanie vzostupnej fázy (1,17 min.) a dĺžky zostupnej fázy (3,1 min.) sme vypočítali pri kravách na tretej a ďalších laktáciách. Výsledky práce potvrdili predlžovanie vzostupnej a zostupnej fázy dojenia s pribúdajúcou laktáciou. Najdlhšia vyrovnaná fáza dojenia (1,90 až 1,92 min.) bola zistená pri prvôstkach a starších kravách holštajnského plemena.

Bimodalita hodnotených kráv dosiahla priemernú úroveň 52 %. Na základe vykonaných meraní sa potvrdilo, že kvalitnejšou prípravou kráv na dojenie je možné výrazne znížiť bimodalitu, resp. skrátiť celkový čas dojenia a tým zrýchliť prechod zvierat dojárňou.

INTRODUCTION

Milkability is described as individual trait of dairy cow, which it characterised functional trait of udder, release ability of milk. Milkability belongs to the group of functional traits. Functional traits are the characters of an animal that increase efficiency, not by higher output of products but by reducing the cost of input [5].

The main emphasis is given on primary traits (production of beef and milk) in the breeding of cattle in Slovakia. Those traits have considerable affect on the breeding economic. Our breeding programmes paid low attention this traits complex. Nowadays it is engaged in research of functional traits raising attention in Slovakia [8].

Usually milkability is measured as milking speed, either recorded instrumentally or with subjective judgment. The usage of milking flowmeters is increasing and spreading at international level [7]. The lactocorder, a mobile milk meter, is used for routine dairy recording in dairy herds. This milkmeter calculates milk flow rate during milking. Lactocorder can be used as a diagnostic tool for evaluating milking procedure problems [9].

More and more countries use the lactocorder to evaluation milkability traits in dairy farms. [2] calculated average value of milkability with lactorocder in Austria. He found out milking speed in Fleckvieh 2.04 kg.min^{-1}, Braunvieh 1.90 kg.min^{-1} and in Holstein cows 2.21 kg.min^{-1}.

The milk flow rate was performed by lactocorder in Bavaria. A total number of observations were 870 165. Average minute milk flow rate was 2.04 kg.min^{-1} in Brown Swiss and lower value 1.80 kg.min^{-1} was found out in Flecvieh. The higher milk flow rate 2.20 kg.min^{-1} was measured in Holstein cows [1]. [4] evaluated of milkability in Croatia. They calculated average milk flow rate 2.52 kg.min^{-1} and maximum milk flow rate 3.88 kg.min^{-1} in Holstein cows. [3] found out parameters of milkability traits in Holstein cows in Korea. Average maximum milk flow per minute was 3.21 kg kg.min.$^{-1}$ and average milk flow rate during main phase of milking was 2.30 kg.min^{-1}. A total produce of milk was 14.14 kg per milking, of it 62 % cows were milked in time first 3 minutes of milking. Average time of milking was 8.23 min.

MATERIALS AND METHODS

The study was carried out in chosen dairy farms in Slovakia. Data set consisted of 63 curves, obtained from different Holstein cows. Measurements were made with electronic mobile milk flow meters – lactocorder. Lactocorder measure milk flow, milk yield and milk conductivity throughout the milking. Milk flow rate is measured every 0.7 seconds, and an average of 4 measurements is stored every 2.8 seconds.

Milkability was evaluating from 5 to 305 days in milk. Cows were milked twice a day (5 hour a.m. and 5 hour p.m.) in tandem milking parlour. The preparation procedure consists of cleaning the udder, massage with wet wiper and dry teats followed by attachment of the milking unit. The milking was automatically ended.

Cows were classified into three groups by parity (1. group - cows in first lactation, 2. group – cows in second lactation, 3. group – cows in third and other lactations).

Following parameters were used in our study: the milk yield per milking, the maximum flow rate, the average flow rate, the duration of main milking phase, the time of increase phase, the time of plateau phase, the time of decline phase and the bimodality.

Bimodality is a parameter in the flow increase phase and records a stimulated double peak flow development at the start of milking. This is reflected in the form of the temporary interruption in the incline after milking out the cistern milk and prior to the on setting milk ejection.

The differences between the groups were tested by the Student-t test. The relation between milk production and the average and maximal milk flow rate per minute was analysed by the Pearson correlation coefficient.

RESULTS AND DISCUSSION

We were evaluating 63 milk flow curves from Holstein cows. The average milking flow pre minute was 2.54 kg.min^{-1} and maximum milking speed was 4.71 kg.min^{-1}. The total milk yield was 15.63 kg.

Lower value of average milking flow rate on -0.64 or -0.63 kg.min^{-1} were found in Germany by Dodenhoff [1] and by Fürst [2] in Austria. Those data were obtained from lactocorder, too. Measurements were made mainly in primiparous cows of Holstein breed within the evaluation of breeding value of bulls. Mijic [4] calculates lower value of average milking flow rate on -0.32 kg.min^{-1}, too. Lee and Choudhary [3] found out average milking speed 2.30 kg.min^{-1} regardless of parity.

Table 1: Milk flow parameters of Holstein cows
Tabuľka 1: Ukazovatele dojiteľnosti kráv holštajnského plemena

[1]Trait	[10]Average	[11]Parity		
		1.	2.	≥3.
[2]Number of cows (n)	63	24	16	23
[3]Milk yield (kg/milking)	15,63	14,03	16,82	16,48
[4]Average milk flow rate (kg.min^{-1})	2,84	2,87	3,01	2,7
[5]Maximum milk flow (kg.min^{-1})	4,49	4,37	4,96	4,3
[6]Bimodality (%)	52	50	50	56
[7]Time of incline phase (min)	1,09	1,01	1,09	1,17
[8]Time of plateau phase (min)	1,82	1,9	1,56	1,92
[9]Time of decline phase (min)	2,26	1,88	3,04	3,1

[1]ukazovateľ,[2]počet kráv, [3]produkcia mlieka na nádoj, [4]priemerný minútový výdojok, [5] maximálny minútový výdojok, [6] bimodalita, [7]vzostupná fáza, [8] vyrovnaná fáza, [9]fáza poklesu, [10]priemer, [11]poradie laktácie

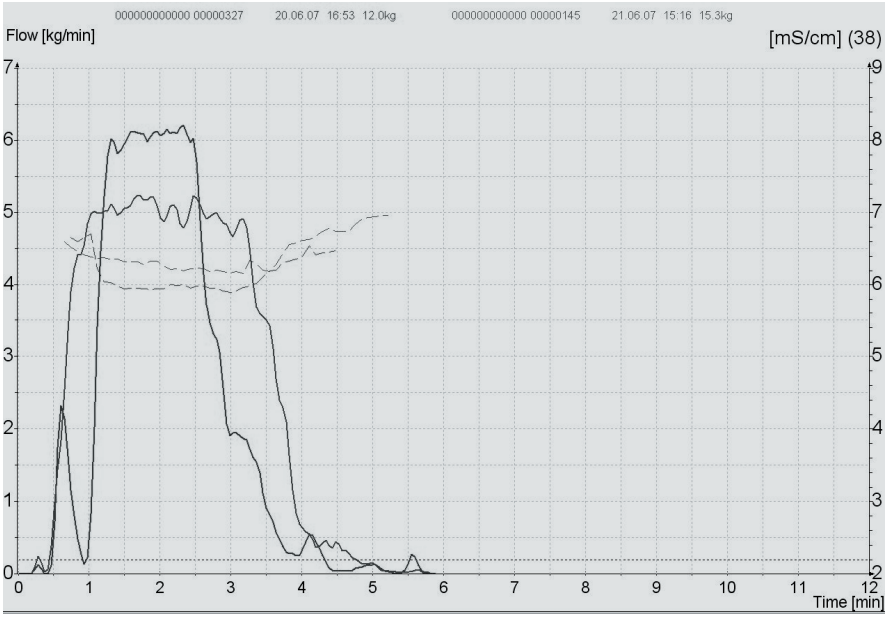

Figure 1. Graphical output of Lactocorder – milk flow curve of adequate and inadequate preparation for milking in cow (with bimodality - sudden decrease milk flow at 96 second from milking start).

Higher value of milkability parameters of cows in our study could have been influenced by lower number of observations and standard of chosen dairy farm.

Most milk flow parameters were influenced by parity order, mainly as a in consequence of different milk production levels. Cows in second lactation had the highest average milking flow rate (3.01 kg.min^{-1}). Primiparous cows had lower average milking flow rate (2.87 kg.min^{-1}) and cows in the third and other lactation were milked average milking flow rate 2.7 kg/min^{-1}. Dodenhoff et al. [1] and Tančin et al. [10] found out the highest average milking flow rate (2.19 kg.min^{-1}) on cows in the third lactation. They calculated lower value of milking speed in second lactation (2.17 kg.min^{-1}) and the lowest value in primiparous cows (2.01 kg.min^{-1}), which was equal with results of our study. The differences among evaluated groups of cows were not significant.

The highest average maximum milk flow rate (4.96 kg.min^{-1}) was found out in cows in the second lactation and 4.37 kg.min^{-1} in the primiparous cows. Lower value of peak milk flow 4.3 kg.min^{-1} achieved cows in the third and another lactation. Lee and Choundhary [3] and by Mijic et al. [4] found out lower average peak flow rate (by -1,28 kg.min^{-1} and by -0,61 kg.min^{-1} , respectively)

We found out a significant interaction between average milk flow rate and milk yield per milking. Similar interactions in these parameters of milkability were reported by Dodenhoff et al. [1].

Bimodality is a parameter in the flow increase phase and records a stimulated double peak flow development at the start of milking. Percentage of bimodal milk flow curves was 52 %, in average. In previous study of Holstein cows lower frequencies of bimodality were registered. Dodenhoff et al. [1] observed percentages of bimodality of 21 %, 24 % and 23 % for Holstein cows in first, the second and the third lactation, respectively. The high percentage of bimodality observed in this study depended on premilking operations.

CONCLUSION

The analysis of the milkability traits of 63 milk flow curves of Holstein cows shows the average milk flow rate 2.84 kg.min^{-1} and the maximal milk flow rate 4.49 kg.min^{-1}, in the total milk yield per milking 15.63 kg. The cows at the second lactation achieve the best milkability parameters. The high occurrence of bimodality (52%) shows the faults during preparation before milking and insufficient expression of the ejection reflex.

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