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TEMPERAMENT OF HOLSTEIN FRIESIAN COWS IN MILKING PARLOUR AND ITS RELATION TO MILK PRODUCTION

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Abstract

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The aim of this study was to evaluate the change of temperament of Holstein cows scored before and during milking during the entire lactation and to calculate correlation between temperament measured in the two moments as well as milk production traits and temperament. Observations were carried out on 17 primiparous Holstein Friesian cows starting their lactation within 85 days. Measurements of temperament and milk production traits were taken once in each month of the lactation, during the morning milking, in a milking parlour. Temperament was assessed in a 5-point scale during udder preparation and milking procedure (1: very nervous, 5: very quiet). Data of milk yield and milk flow were collected individually on each test day morning. Results showed changes during the lactation in temperament of cows scored directly before milking ($P < 0.01$), however, temperament during milking did not alter with months ($P > 0.10$). By correlation coefficients, behaviour assessed in the two moments cannot be regarded as the same. In addition loose, significant relations were found only between milk traits and temperament before milking.

behaviour, lactation, milk production, dairy cows, animal welfare, Holstein Friesian (HF)

One of the major topics of applied ethology is animal welfare. It relates primarily to ability of animals to cope both with their external (including housing, management, weather and the presence of other animals), and internal environment. The factors influencing animal welfare depend on the housing system (PHILLIPS, 2002). If any marked deviation perceived by the individual has occurred in the harmony between an animal and its environment in a certain housing or milking system, it results in a welfare deficit due to negative emotional experiences. In case of animals, only behavioural and physiological investigations help to detect emotions. Emotional responses are generally evaluated by behavioural tests, which are often carried out on events that animals have to face during management practices in the farm (DÉSIRÉ et al., 2002).

This means that measuring behaviour of cattle is one of the ways to describe the level of animal well-being in a herd (BUDZYNSKA et al., 2005). These measurements are generally based on a linear scale on which responsiveness of animal is estimated. For example, the sensibility of the nervous system in cattle is assessed by measuring temperament of animals in different test situations (FORDYCE et al., 1982; BURROW, 1997). It is likely that statements on animal welfare in cattle breeding are increasingly coming to the front, since negative factors accompanying intensive housing system are getting more and more known (ROLLIN, 1995).

Temperament has become one of the important traits to detect the welfare of cattle. It is defined as the type and volume of reaction to environmental stimulations (e.g. management by humans, housing system etc.), and is examined as a behavioural response of animals to handling by humans (BUCHERAUER, 1999). Temperament as a trait reflecting the sensibility of the nervous system is closely related to the metabolism since both the rate of metabolism and sensibility of the nervous system

are regulated by thyroid hormones (STEFLER et al., 1995).

Nervous behaviour (too much sensibility) can cause various problems that are disadvantageous in milk production:
- increasing costs
- difficult handling of animals
- risk of damaging farm equipments, and of becoming dangerous for humans (McDONALD, 2003).

Temperament of dairy cows has been often assessed in milking parlour (LEWIS AND HURNIK, 1998). Milking in loose housing system typically involved cows being driven to, and crowded at the waiting area, along with being individually milked in a milking parlour generally twice a day. Fear of the milker and discomfort due to the milking procedure may make the cows feel unpleasant during milking (ROUSING et al., 2004). This inconvenient status is expressed by stepping behaviour. Animals with its behaviour and level of its production reflect, if there are not any opportunities in their environment for manifestation of the standard behaviour patterns. It has been also reported that there is a connection between stepping and cow's character (METZ-STEFANOWSKA et al., 1992).

Dairy temperament tests compose a separate category among methods for measuring temperament, as they relate directly to milk production. Behaviour of cows is assessed subjectively in different scoring systems, such as 1–3, 1–4 or 1–5 scales during the milking procedure (DICKSON et al., 1970; KHANNA AND SHARMA, 1988).

Numerous studies have reported relation between milk production and temperament of dairy cows (BURROW, 1997). ROY AND NAGPAUL (1984) compared the milk yield of different breeds with different temperament. One of the calmest breed (Karan Fries) was experienced to have the highest milking speed and daily milk yield in contrast to an anxious breed (Murrah buffalo), which had the lowest values of the observed traits. LAWSTUEN et al. (1988) calculated correlation between milk production traits and temperament of Bos Taurus cows. The associations of temperament score with milking speed and with FCM were 0.36±0.11, and 0.19±0.11, respectively. The relation of milk production and temperament was confirmed by observations of NEMA et al. (1999), as well. However, KHANNA AND SHARMA (1988) did not find any correlation between milk production and temperament in Bos Indicus x Bos Taurus cows. Similarly to the previous result, neither could CZAKÓ (1978) reveal significant correlation between milk production and behaviour scored during milking. He did not realise any difference between high and low producing cows in temperament. BUDZYNSKA et al. (2005) assessed the correlation of behaviour before milking in a parlour with time spent wiping the udder, time spent fitting the milk cluster, milk yield and age in 131 Holstein Friesian cows. The two time parameters were lower in quiet animals compared with excitable cows. However, there was no significant correlation between behavioural scores and either milk yield or cow's age.

Based on these studies, it can be concluded the fact that good temperament results in higher milk yield has not been definitely proven.

Present study reports the reactions of Holstein Friesian cows milked in a herringbone parlour in a certain farm environment considering milk production, throughout the entire lactation. The objectives of this study were to determine the monthly change of temperament scored before and during milking, and to calculate correlation between temperament measured in the two moments as well as temperament and milk production traits.

MATERIAL AND METHODS

The observations were carried out in a Hungarian herd, in Csomád, on 17 primiparous Holstein Friesian cows throughout their whole lactation from December, 2005 to November, 2006. Cows being in early stage of lactation were selected for the experiment. At the beginning of December, only 10 primiparous animals were chosen, as they were in lactation since less than 85 days: 7 cows were in 30 days, and 3 cows were in 60–85 days. However, due to the low number of individuals, in the next month the group was expanded by 7 cows starting their lactation within 40 days.

Investigations were carried out with the chosen animals once in each month of the lactation, one week before the official milk recording, during the morning milking in a herringbone-milking parlour.

Temperament was assessed in a 1–5 points scale from the milking shaft, during udder preparation and milking procedure as well (BUDZYNSKA et al., 2005):

1 = very nervous, continual and vigorous stepping and kicking
2 = continual and vigorous stepping but there is no kicking
3 = occasionally vigorous leg movements
4 = quiet standing with few slight leg movements
5 = very quiet, no leg movements.

Scorings were recorded at each milking and were fixed in tables.

The morning milk production traits were also collected individually on each test day when temperament was measured (Table I.).

I: *Mean and standard deviation of milk yield and milk flow at morning milking by months*

Months	Individual number, n	Milk yield, kg	Milk flow, kg/min
December	10	15.53±1.51	2.11±0.86
January	17	16.00±2.32	2.58±0.61
February	17	16.55±2.37	2.65±0.72
March	17	15.47±3.60	2.76±0.65
April	17	15.98±2.60	2.93±0.63
May	17	16.89±2.79	3.00±0.59
June	17	15.30±3.06	2.76±0.64
July	15	14.34±3.47	2.85±0.77
August	11	14.47±3.05	2.71±0.56
September	10	13.73±2.83	2.75±0.61
October	8	12.73±3.09	2.60±0.57
November	6	12.13±2.57	2.58±0.72

Animals participated in the test were kept in loose housing system, under the same farm environment and condition score and were milked by the same handlers.

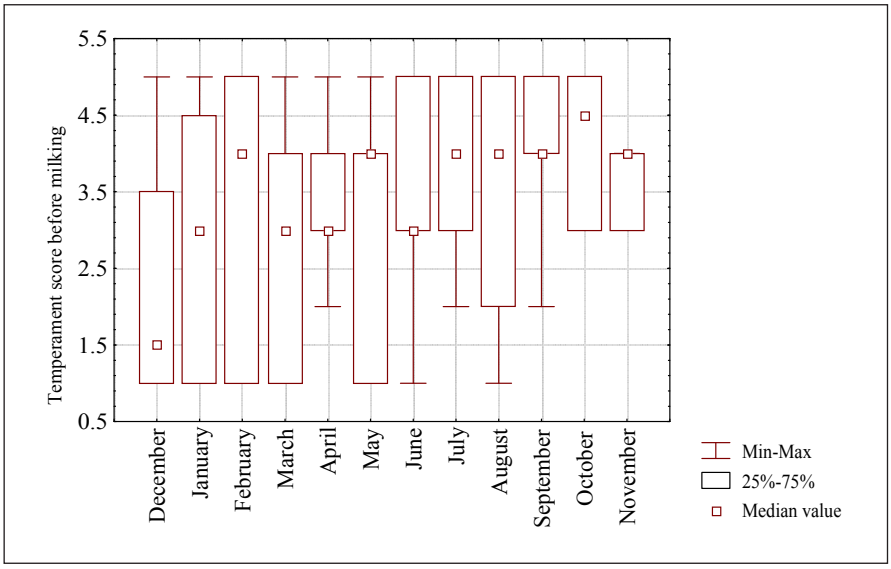
Statistical analyses of data were performed with SPSS 14.0 program package. Descriptive statistic program were applied for determining median, minimum and maximum values of temperament. For calculating the effect of month on temperament, non-parametric test such as Friedman ANOVA test was used. Relation between temperament scores before and during milking, just like the association of temperament with milk traits were assessed by Spearman rank correlation test.

RESULTS AND DISCUSSION

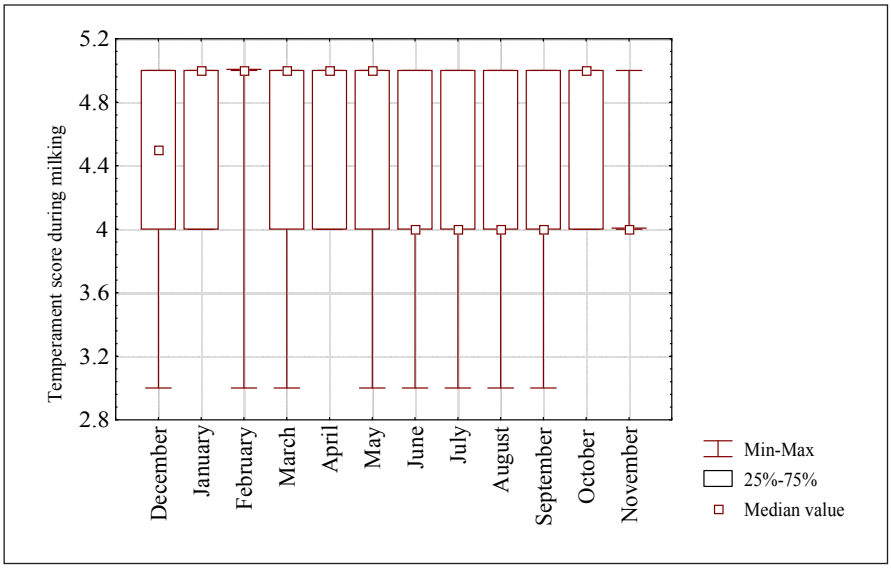
The effect of month on temperament was analysed by Friedman ANOVA test. It revealed significant difference between months in temperament assessed directly before milking [Chi-square (df: 11) = 25.884, $P < 0.01$]. This means that temperament of primiparous Holstein Friesian cows scored during udder preparation was altering during the lactation. At the beginning of experiment temperament score was 1.5, then it was varying between 2.0 and 4.0 till the end of lactation, except in October, when the score reached its highest value, 4.5 (Figure 1). Accordingly, in the first month of lactation the primiparous cows were very nervous during udder preparation, but in the next months they calmed down. Moreover, in October animals were definitely calm. This result indicates that primiparous cows were permanently getting used to the milking system. It was supported by driving the animals on their late-pregnant-days several times through the milking parlour.

However, difference between months in temperament scored during milking was not proven [Chi-square (df: 11) = 7.488, $P > 0.10$]. Consequently, temperament assessed during milking did not change significantly in the lactation. In the experiment cows obtained 4.0, 4.5 and 5.0 scores, consequently they were calm during milking (Figure 2). On one hand, the reason of it might be that cows' comfort increases when their udders are not strained by milk. On the other hand, releasing milk has extremely resort to the organism of cows, especially to those producing high milk yield, so that most of them not only stand peacefully, but they also stop eating the concentrate during milking. CZAKÓ (1978) revealed in his experiment that 86.8% of Hungarian Simmental cows with high milk production (more than 20 kg daily milk yield) showed calm behaviour with few leg movements, and only 13.2% of cows stepped several times for the duration of milking.

Nevertheless, the results of month effect on temperament before milking eliminate the inadequate management of cows, for example hitting, kicking on the farm. Otherwise, animals are assumed to be nervous and dynamically stepping and kicking during udder preparation, not only at the beginning, but throughout the lactation. ROUSHEN et al. (1999) investigated the association of milking behaviour with the quality of the human-animal relationship and found that in the presence of an aversive handler some dairy cows showed increased stepping behaviour, while other cows showed decreased stepping behaviour even though both behavioural responses related to increased heart rate. Further, WENZEL et al. (2003) noted that stepping behaviour during milking is expressed mostly by nervous and excited cows.



1: *Median values of temperament before milking by months*



2: *Median values of temperament during milking by months*

Correlations between behaviour during udder preparation and milking were monthly observed by Spearman rank correlation test (Table II.). Positive, statistically confirmed correlation coefficients were calculated in February ($r_{rank} = 0.48$, $P < 0.05$) and in June ($r_{rank} = 0.52$, $P < 0.05$), which show moderately close connection between temperament measured for the duration of udder preparation and milking. Considering the entire lactation, positive, loose correlation could be revealed between the two scores ($r_{rank} = 0.28$, $P < 0.001$). ZENGŐ et al. (2007, unpublished) demonstrated similar results in their behavioural examination conducted on 21 primiparous and 19 multiparous Holstein Friesian cows in the milking parlour for 4 months. Positive, loose relations were detected between temperament scores recorded before and during milking, in addition to correlation coefficients were indicated to be significant only in May ($r_{rank} = 0.29$; $P < 0.01$) and if regarding the entire period ($r_{rank} = 0.16$; $P < 0.01$). Since results did not reveal any tendency in connection of the two temperament scores, significant correlation values calculated in February, in June and in the whole lactation can be considered as the consequence of haphazard by contributing many factors. The results of correlation imply that behaviour of cows is different in the two situations since the two scores cannot be regarded as equal. It is likely that two behavioural patterns express reactions to different environmental and internal factors. It can be concluded by the results that both measurements of temperament (before and during milking) are needed to describe the behaviour of cows in milking parlour.

II: *Correlation coefficients calculated between temperament scores before and during milking by months*

Correlation between certain traits	Months	Number of individual, n	Spearman rank correlation coefficients, r_{rank}	P-level
Temperament scores before milking & Temperament scores during milking	December	10	0.35	P > 0.10
	January	17	0.22	P > 0.10
	February	17	**0.48**	**P < 0.05**
	March	17	0.39	P > 0.10
	April	17	0.20	P > 0.10
	May	17	*0.46*	*P < 0.10*
	June	17	**0.52**	**P < 0.05**
	July	15	–0.14	P > 0.10
	August	11	0.31	P > 0.10
	September	10	*0.57*	*P < 0.10*
	October	8	0.37	P > 0.10
	November	6	0.32	P > 0.10
	The whole lactation	162	**0.28**	**P < 0.001**

Relationship of temperament with milk production traits (milk yield and milk flow) were determined by Spearman rank correlation test, as well. Correlation was analyzed by seasons and the following season codes were used in the statistical analysis:

1. Winter = December, January, February (number of individuals, n = 44)
2. Spring = March, April, May (number of individuals, n = 51)
3. Summer = June, July, August, (number of individuals, n = 43)
4. Autumn = September, October, November (number of individuals, n = 24)

The statistical test indicated loose, both positive and negative connections between behaviour showed directly before milking, milk yield and milk flow in seasons (Table III.). Significant correlation coefficients were calculated only between temperament and milk yield concerning the whole lactation (r_{rank} = –0.17; P < 0.05; n = 162), and between milk flow and temperament in winter season (r_{rank} = 0.31; P < 0.05; n = 44). These values are very low and the significance of them is resulted in by the high individual number, consequently these correlation coefficients are not worth taking into account in profession. Nevertheless, negative values could be explained by the fact that cows with high milk yield are more sensible to handling than cows producing less milk. In our previous study (SZENTLÉLEKI et al., 2006), it has been proven (P < 0.05) that cows with nervous temperament before milking produced less milk, in addition have lower milking speed compared with quiet animals. However, BUDZYNSKA et al. (2005) did not experienced any relation between temperament during udder preparation and milk yield.

There were no statistically confirmed connections between temperament during milking, milk yield and milk flow (Table IV.). The most of correlation coefficients were positive and very low. Similarly to this result, neither KHANNA AND SHARMA (1988) nor CZAKÓ (1978) observed the association of milking behaviour with milk yield. On the contrary to these results, there are a number of studies reporting about the connection of milking temperament and milk production traits (GUPTA AND MISHRA, 1979; ROY AND NAGPAUL, 1984; LAWSTUEN et al., 1988; NEMA et al., 1999). In all cases, the calmest cows had the highest milk yield and milk flow.

Since the papers contradict each other, the correlation cannot be regarded as obvious. For that reason, further analyses need to be performed to reveal the association between milk production and temperament before/during milking. However, a complex correlation has been already confirmed among behaviour during milking, reaction towards human, daily milk yield, milking system, physiological indicators and health status of dairy cows. So, measuring temperament during milking may be relevant as part of a welfare management tool serving to indicate welfare problems relating to udder health, milking techniques and quality of handling routines in the herd (ROUSING et al., 2004).

Dairy test applied in this experiment can be easily learned, whereas by our experiences, the 1-5 scoring system needs to be developed for determining temperament more exactly.

Several European countries have already introduced the temperament of dairy cows as one of the indicators of workability into their selection program. The Netherlands, Belgium, France, Finland and Denmark apply 1–5 scoring system for assessing temperament, while Norway prefers 1–3 scoring scale (INTERBULL, 2006). By modifying the genotype of cattle to the farm environment, humans have improved their welfare. Selection for suitable temperament has enabled cattle to cooperate with humans in a definite environment (PHILLIPS, 2002).

III: *Correlation coefficients calculated between temperament before milking and milk production traits by seasons*

Correlation between certain traits	Seasons	Number of individual, n	Spearman rank correlation coefficients, r_{rank}	P-level
Temperament scores *before milking* & milk yield	Winter	44	–0.14	P > 0.10
	Spring	51	–0.23	P < 0.10
	Summer	43	0.07	P > 0.10
	Autumn	24	–0.02	P > 0.10
	The whole lactation	162	**–0.17**	**P < 0.05**
Temperament scores *before milking* & milk flow	Winter	44	**0.31**	**P < 0.05**
	Spring	51	–0.03	P > 0.10
	Summer	43	–0.07	P > 0.10
	Autumn	24	0.03	P > 0.10
	The whole lactation	162	0.08	P > 0.10

IV: *Correlation coefficients calculated between temperament during milking and milk production traits by seasons*

Correlation between certain traits	Seasons	Number of individual, n	Spearman rank correlation coefficients, r_{rank}	P-level
Temperament scores *during milking* & milk yield	Winter	44	–0.07	P > 0.10
	Spring	51	–0.08	P > 0.10
	Summer	43	0.12	P > 0.10
	Autumn	24	0.15	P > 0.10
	The entire lactation	162	0.06	P > 0.10
Temperament scores *during milking* & milk flow	Winter	44	0.08	P > 0.10
	Spring	51	0.10	P > 0.10
	Summer	43	0.27	P > 0.10
	Autumn	24	0.33	P > 0.10
	The entire lactation	162	0.15	P < 0.10

SOUHRN

Temperament holštýnsko-frízských krav při dojení v dojírně a jeho vztah k mléčné produkci

Jedním z hlavních témat aplikované etologie je welfare zvířat. Jedná se o primární schopnost zvířat adaptovat se jak na vnější vlivy, zahrnující ustájení, management, počasí, přítomnost ostatních zvířat, tak vnitřní vlivy. Temperament se stal jedním z důležitých faktorů zjišťování welfare skotu. Je definován jako typ a míra reakce k environmentálním podnětům a je hodnocen jako odezva chování zvířat na zacházení s nimi. U dojených krav se temperament nejčastěji hodnotí v dojírně. Měření je založeno hlavně na lineární stupnici a hodnotí se subjektivně v různých bodovacích systémech.

Prezentovaná práce popisuje reakce holštýnsko-frízských krav dojených v rybinové dojírně v podmínkách mléčné farmy po dobu celé laktace. Cílem práce bylo zjistit změny v temperamentu před a současně během dojení a vyhodnotit korelační závislosti mezi těmito dvěma měřenými okamžiky a mezi temperamentem a produkcí mléka. Pozorování bylo prováděno na 17 prvotelkách v průběhu jejich celé laktace od prosince 2005 do listopadu 2006. Krávy se nacházely v raném stadiu laktace. Hodnocení probíhalo v průběhu ranního dojení v rybinové dojírně týden před kontrolními odběry mléka každý měsíc v laktaci. Temperament byl měřen 1–5bodovou stupnicí během přípravy vemene a v průběhu dojení. Vliv měsíce na temperament byl analyzován pomocí Friedmanova ANOVA testu. Vztah mezi temperamentem před a při dojení a asociace temperamentu s produkcí mléka byl hodnocen Spearmanovým korelačním testem.

Byly prokázány změny temperamentu během laktace při přípravě vemene na dojení (P < 0,01), avšak při vlastním dojení nebyly mezi měsícem a temperamentem nalezeny průkazné rozdíly v tempe-

ramentu (P > 0,10). Statisticky významné korelační koeficienty byly zjištěny mezi temperamentem a množstvím mléka v průběhu celé laktace (r = –0,17; P < 0,05) a mezi průtokem mléka a temperamentem v zimním období (r = 0,31; P < 0,05).

chování, laktace, mléčná produkce, dojnice, pohoda zvířat, Holštýn

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