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THE EFFECT OF LAMENESS ON MILK PRODUCTION ON A HOLSTEIN-FRIESIAN FARM

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Abstract

The aim of this study was to determine the effect of lameness on daily milk yield, milk fat and protein. 3378 data of 978 animals were monitored for all conditions (locomotion, milk production and milk content) during two years, monthly. The prevalence of lameness was different in several parity and stage of lactation.
The effect of lameness on daily milk yield was complex and interacted with the stage of lactation. In the first stage of lactation the lame cows produced more milk than the not lame. The milk yield in the next period was almost equal, after the 120th day the milk production of not lame cows was higher than that of the lame cows. We conclude that lameness reduced milk production and milk protein content during the lactation. This same relation was not found in case of milk fat percentage.

***Key words**: dairy cow, lameness, milk production, milk component.*

INTRODUCTION

The genetic progress of the dairy cattle population is significant, however selection for increased milk, fat and protein yield has led to unfavourable correlated changes in reproductive performance (Chagas et al., 2007; Mokhtari et al., 2015; Pryce et al., 2004), and also to some diseases like ketosis (Raboisson et al., 2014), milk fever, lameness (Dechow et al., 2004) mastitis, and others (Alawneh et al., 2014).
Lameness in dairy cows is a multifactorial and progressive disease with complex interactions between risk factors contributing to its occurrence (Randall et al., 2015). Extensive effects on herd performance are published, including milk yield loss (Alawneh, Stevenson, Williamson, Lopez-Villalobos and Otley, 2014) and impaired reproductive performance (Mokhtari, Moradi Shahrbabak, Nejati Javaremi and Rosa, 2015). The significance of these effects extends beyond the financial implications.
The rate of lameness depends on milk production, body condition and parity, and according to (Archer et al., 2010) it was more likely associated with high milk yield in multiparous cows.
In addition, lameness is a major problem for the dairy industry in terms of animal well-being (Alsaaod et al., 2012; Bicalho and Oikonomou, 2013; Solano et al., 2015). Lame animals show behavioural signs of being in pain (Vieira et al., 2015) such as reduction in mobility and alterations in behaviour (Miguel-Pacheco et al., 2014; Navarro et al., 2013). Due to discomfort and changes in behaviour lameness has been associated with a reduction in milk production. The signs of changed behaviour included impaired locomotory ability and reduced feed intake which can be associated with weight loss and milk yield reduction (Charlton et al., 2016). Beside milk yield losses, the correlation between lameness and BCS is significant.
Results of Lim et al. (2015) suggested that both a decrease and an increase in BCS influence the risk of becoming lame and regular monitoring and maintenance of BCS on farms could be a key tool for managing the risk of lameness.
In summary, lameness is one of the most significant endemic disease-problems facing the dairy industry (Thomas et al., 2015).
Lameness has an economic impact (Ettema and Østergaard, 2006) on the herd, involving

decreased milk production, loss of value of production, change in live weight, treatment cost, replacement costs, early culling, extra labour costs and prolonged calving interval (Enting et al., 1997).
The importance of prevention is unambiguous and the early recognition and treatment of lameness is fundamental to mitigate its negative effects (Solano et al., 2016).
The early treatment of lame dairy cows resulted in the development of less severe lesions, increasing the chance of full recovery and decreased the amount of time an animal was lame (Groenevelt et al., 2014).
According to Defrain et al. (2013) the collected foot health records are useful in monitoring the degree of lameness within dairy herds and, perhaps more importantly, providing insight into the underlying factors causing lameness. In addition, locomotion scoring has been globally adopted to determine the prevalence and severity of lameness.
The aim of this study was to investigate the impact of clinical lameness in Hungarian dairy cows on milk yield and milk composition in different parities and stage of lactation.

MATERIALS AND METHODS

The study was carried out on a dairy cattle farm in Hungary. The dataset included 3378 monthly test day milk yield, from 976 cows in first to five lactations during a two years period.
Once a month after the milk-test-day the cows were examined for lameness according to their locomotion (lame, non-lame).
Individual cow milk yields were estimated on a monthly test throughout the lactation.
The milk fat and protein-content was collected from evening and morning milking (alternate samples), the samples weighed, and a subset of the combined evening and morning milking taken for the determination of SCC, milk fat and protein concentration (Hungarian Dairy Herd Recording).
Statistical analyses were performed using SPSS 18. Data were analysed using two-ways ANOVA model. The prevalence of lameness in the different lactations and the different stages of lactation were compared using a Chi-squared.

RESULTS AND DISCUSSIONS

The prevalence of lameness (Figures 1 and 2) is varied widely between parity (13-41%) and the different stages of lactation (16-32%). During the examination of DIM (Figure 1) number of lame cows were the highest between 231-300 days of lactation. Lameness prevalence increased with increasing days of lactation and it differed statistically (Chi^2=39.93, df=5, P<1%). The lowest lameness prevalence occurred in the first stage of lactation (1-60 days). A 16%-point increase was present in lameness cases from 1-60 days to 300 days whereas prevalence was the highest (38%, n=176). This tendency was observed in other authors' studies. According to Solano et al. (2015) lameness increased with increasing DIM. Main et al. (2010) and Espejo and Endres (2007) found that longer time spent in milking was significantly associated with increased prevalence of lameness.

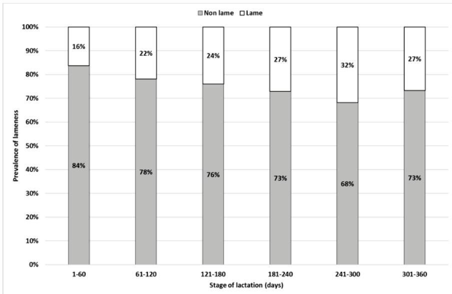

Figure 1. The prevalence of lameness in different stage of lactation

The prevalence of lameness was also different in several parities. Figure 2 shows that the lowest prevalence occurred in first lactation (13%), while it was highest in 5th lactation (41%). The difference between the first and 5th parity was 287% (Chi^2=144.55, df=4, P<1%). Summarizing the results, lameness was associated with increased DIM and parity.
The effect of lameness on daily milk yield was complex and interacted with the stage of lactation (Table 1). In the first stage of lactation the lame cows produced more milk than the not lame. The difference between groups was 1.25 kg (P>5%). The milk yield in the next period was almost equal, after the 120th day the milk production of not lame cows was higher than that of the lame cows.

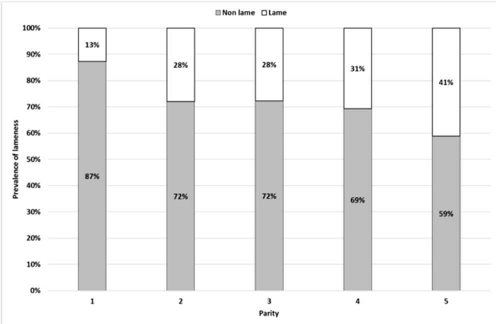

Figure 2. The prevalence of lameness in different parities

The milk production difference of lame and not lame cows changed from 1.15 kg to 1.8 kg (241-300 days).

During the lactation the decline in milk production is a natural process, however the decrease of the milk yield of lame cows was higher (16.28 kg) than in case of not lame ones (13.1 kg).

According to the two ways anova method the effect of the stage of lactation and lameness on daily milk yield is significant, similarly to the interaction of two effects (P=0.016).

Table 1. The effect of lameness on daily milk-, fat- and protein yields and SCC

Stage of lactation (days)	Lameness	n	Daily Milk Yield (kg)	P %	Fat (%)	P %	Protein(%)	P %
1-60	non lame	349	31.61±7.09	0.064	3.46±0.75	0.262	3.04±0.29	0.021
	lame	68	33.36±6.99		3.35±0.63		2.95±0.33	
61-120	non lame	459	30.37±6.71	0.966	3.64±0.73	0.834	3.27±0.31	0.000
	lame	129	30.34±7.48		3.65±0.68		3.11±0.33	
121-180	non lame	425	28.28±6.60	0.012	3.81±0.71	0.719	3.36±0.28	0.002
	lame	134	26.62±6.73		3.83±0.78		3.27±0.32	
181-240	non lame	440	25.11±6.64	0.053	3.86±0.82	0.998	3.45±0.32	0.001
	lame	164	23.96±6.08		3.86±0.62		3.35±0.30	
241-300	non lame	377	21.14±7.15	0.005	4.02±0.80	0.598	3.60±0.33	0.003
	lame	176	19.34±6.67		3.98±0.85		3.50±0.36	
301-360	non lame	255	18.51±6.60	0.136	4.11±0.90	0.958	3.74±0.38	0.035
	lame	93	17.33±6.40		4.12±0.78		3.64±0.36	
Effects and interactions			Stage of lactation P<1%, lameness P<1%, Lameness x Stage of lactation P<5%		Stage of lactation P<1%, lameness P>5%, Lameness x Stage of lactation P>5%		Stage of lactation P<1%, lameness P<1%, Lameness x Stage of lactation P>5%	

Several authors reported relationship between milk solids (fat and protein) and lameness. Penev and Stankov (2015) reported that the milk fat percentage of lame cows reduced by 0.16%, and milk protein - by 0.04% compared to healthy cows.

According to Olechnowicz and Jaskowski (2010) the cows, which were never lame in early lactation and the cows, which were mildly lame (score 2), produced more milk, fat, protein, and lactose per month as compared with cows, which were clinically lame for one month and compared with the cows, which were clinically lame longer than one month.

According to Enting et al. (1997), cows, which were culled for lameness, had lower milk fat, and protein production, by 14.1%, and 16.4%, respectively. In our study, the milk fat % was greater with higher days in milking, however the value did not differ significantly by lameness. Not lame cows had greater milk protein content compared with lame cows (P<5%).

CONCLUSIONS

In this study, we investigated the effect of lameness on milk production, milk fat and protein.

Lameness prevalence increased with increasing days of lactation and it differed statistically (Chi^2=39.93, df=5, P<1%). Prevalence of lameness also differed significantly in terms of the number lactation (Chi^2=144.55, df=4, P<1%). Lame cattle in all lactation periods (except for the first period) had lower milk production than that of the not lame cows. We conclude that lameness reduced milk production and milk protein content. during the lactation. This same relation was not found in case of milk fat percentage.

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