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Original Scientific Paper

**THE EFFECT OF ASEPTIC PODODERMATITIS
ON MILK PRODUCTION**

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Abstract

Lameness in high-yielding dairy cows is one of the main factors of economic losses on farms. These losses include treatment costs, reduced milk production, reduced fertility, and an increased number of cows excluded from production. Lameness in cows is a painful condition that leads to lying down for a longer period of time, refusal to move as well as reduced food consumption. Reduced food consumption consequently leads to reduced milk production. The experiment was performed on a dairy farm in Vojvodina. The aim of this study was to examine the effect of aseptic pododermatitis on milk yield in cows. The experiment included 40 Holstein-Friesian cows in their second lactation. All selected cows had the same body condition score and were at the same phase of lactation. The cows were divided into 2 experimental groups. The first group included cows diagnosed with laminitis and with pronounced lameness. The second group included healthy cows without pronounced lameness. Daily milk production was measured initially in both groups of cows, and then on the 1st, 7th, and 21st day after hoof processing in a group of cows diagnosed with laminitis. After statistical processing of the obtained results, a significantly lower daily milk production was observed in cows with pronounced symptoms of aseptic pododermatitis compared to healthy cows. It was also noticed that, during the first 7 days after treatment, there was no significant increase in milk production in cows with aseptic pododermatitis. On the first day after treatment, reduced milk production was noticed, as a consequence of the additional stress to which the cows were exposed during the processing and therapy of the hooves. The greatest exponential growth in milk production in treated cows was recorded between 7 and 21 days after treatment, with a significant increase only after three weeks.

Key words: aseptic pododermatitis, cows, milk production

INTRODUCTION

Intensive cattle breeding, especially of fattened heifers and early lactated cows, is

frequently associated with the occurrence of aseptic pododermatitis. It mainly occurs after a sudden change in diet, calving associated with placental retention, mastitis, vaccination, antibiotics administration, severe parasitic infections, and may have an acute, subacute, and chronically recurrent form. In the acute form, the disease is manifested by pain in the hooves and the inability or avoidance of relying on the hooves. Lameness in cattle is the third most important health disorder, after reproductive disorders mammary gland diseases. Lameness in cows leads to a significant decrease in milk production.

For many years, the pathogenesis of laminitis in cows has been identified with the pathogenesis of laminitis in horses. A disorder in the corium microcirculation with consequent degenerative and inflammatory changes of the dermo-epidermal junction was described as a central event. With this assumption, Ossent and Lisher (1998) described pathogenesis more detail, analyzing changes in the hooves of slaughtered animals. They presented the pathogenesis of laminitis in phases. The primary reaction in the first phase occurs in the vascular system under the influence of vasoactive substances, such as histamine and endotoxins that cause paralysis and vasodilatation. This leads to blood stasis with consequent hypoxia and transudation. Transudation leads to edema. In the further evolution of the process, bleeding, thrombus formation, and finally necrosis occur (Nocek, 1997). Macroscopically, on the pathoanatomical section, staining of the corium, especially the lamina, in a dark red color can be noticed, due to thrombosis and bleeding. Due to the impossibility of spreading the tissue inside the corneal capsule, this process is extremely painful, because of the pressure on the nerve endings increases. The cells of the basal layer of the epidermis synthesize keratin as the basic building component of the hoof horn. Nutrients that are delivered to the blood vessels of the corium are necessary for horn synthesis and cell division. Due to hemostasis and other changes, the amount of nutrients is reduced and the dermo-epidermal connection is weakened. This is a needed and sufficient reason for the beginning of the coffin bone sinking, which is considered as the beginning of the second phase.

However, in some cases, the changes on the laminae are not noticeable, although the coffin bone has already done damage by pressing on the structures of the planar corium and subcutis (Lisher and Ossent, 2002). Logue (2004) explains that, in these cases, the process of reducing the thickness of the fat pads is more significant, due to their reduced capacity to absorb the pressure of the coffin bone. The sinking of the coffin bone also means more intense pressure on the plantar cortex, which causes ischemia, damage of capillaries, hemorrhage, thrombosis, cellular inflammatory reaction and finally ischemic necrosis. At this stage, clinical changes on coffin capsule are still not visible.

In the third phase, which occurs about eight weeks after the onset of the initial changes, the changes are visible. Until recently, these changes were considered as separate clinical entities and were described as such. Accumulation of exudates between laminae, lamellar hyperplasia, or separation of the horn of the sole from the wall horn (white line disease) occurs. Necrotic tissue is incorporated into a newly synthesized horn. This can be noticed

macroscopically in the form of red spots in the horn, which may be seen during the hoof correction. Ulceration occurs when the synthesis of the horn is completely disabled. Necrosis most often occurs in those places of the plantar horn where the pressure is most intensive (Enevoldsen, 1991). Over time, the changes become visible from the outside. The hooves become wider and flatter, and the dorsal edge of the hoof grows in a different direction, meaning that follows the newly established direction of the coffin bone (Amstel, 2006).

Lameness of the cows in a painful condition that leads to laying down for a long period of time, refusal to move as well as reduced food consumption. Reduced food consumption consequently leads to reduced milk production.

Rajala-Schultz et al. (1999) and Warnick et al. (2001) found a decrease in milk production due to lameness. Their studies used veterinary diagnosis instead of locomotion scoring for the lameness assessment. Rajala-Schultz et al. (1999) found that lame cows give 1.5 to 2.8 kg less milk per day, 2 weeks after the diagnosis of lameness. Warnick et al. (2001) also found that lame cows, in two herds, produced 0.8 to 1.5 kg less milk per day, 2 weeks after the diagnosis of lameness. Comparing cows with a score of 4 and a score of 1 to 3 (lameness score) in the same herd, they found a reduction of production and came to a result of 4.0 and 2.8 kg reduction in the amount of milk per day.

It is very important and scientifically interesting to emphasize that there are differences in the test results related to the influence of lameness on the amount of milk. Some studies have found a reduced milk yield during clinical lameness (Whitaker et al., 1983; Tranter and Morris, 1991; Warnick et al., 2001; Green et al., 2002), while others suggest that there is no milk yield reduction (Martin et al., 1984). Barkema et al. (1994) present data of increased milk yield, between 100 and 270 days in milking, at the time when sole ulcers were diagnosed in cows. These authors concluded that the impact of lameness on milk production should be calculated using the deviation of the lactation curve of daily milk yields instead of cumulative production. This is especially true for cows with above-average production because a decrease in total milk production means that these cows will have average but not under an average production, which means that this decrease will not be detected by analyzing total production (Lucei et al., 1986). The relationship between the health of the hoof and milk production is complex. Clinically visible locomotor disorders reduce milk production before, during, and after hoof disease (Enting et al., 1997; Rajala-Schultz et al., 1999; Warnick et al., 2001; Green et al., 2002). Some authors claim (Barkema et al., 1994; Flaisher et al., 2001) that foot diseases are usually associated with high levels of milk production in the same or previous lactation. However, Dohoo and Martin (1984) could not prove such a relationship. Green et al. (2002) presented the results of a study done on 900 cows in the UK and he observed milk yield reduction up to 5 months before, as well as 4 months after lameness was diagnosed. The loss at the level of standard lactation was 396 kg of milk. These authors found that in cows that were lame at least once during lactation, milk production was lower by 366 kg compared to cows that never suffered from

any hoof disease. Singh et al. (1993) proved that lame cows lay for a longer time compared to healthy ones, as well as that they consumed less food. Green et al. (2002) found that lameness is more common during early lactation. Onyiro et al. (2008) observed that milk yield is affected, not only by the day of milking, but also by the month in which the cows were calved, and indicated on the significant influence of the season on milk production. They found that milk production, in the first 60 days of lactation, was significantly higher in cows that were lame at least once, compared to cows without lameness.

MATERIALS AND METHODS

The experiment was performed on a dairy farm in Vojvodina. The experiment included 40 Holstein-Friesian cows in their second lactation. All selected cows had the same body condition score and were at the same phase of lactation. The cows were divided into 2 experimental groups. The first group included cows diagnosed with laminitis and with pronounced lameness. The second group included healthy cows without pronounced lameness. Daily milk production was measured initially in both groups of cows, and then on the 1st, 7th, and 21st day after hoof processing in a group of cows diagnosed with laminitis. The average body weight of cows was 600 +/- 50 kg. During the study period, cows were fed standard mixed meals twice a day. Meal optimization was performed on the basis of body weight and lactation phase. All cows included in the experiment received the same meal. During the experiment, the consumption of food was monitored, i.e. the intake of dry matter in relation to the optimal needs for that category of cows. Milk production was measured by a software device on an automatic milking parlor on the farm.

After the obtained results on the amount of milk in the examined groups and periods, the data were processed with descriptive statistical parameters: arithmetic means, standard deviation, standard error of the arithmetic mean, coefficient of variation, and are presented in a table. The student's T-test was used to analyze the degree of significance of the difference between the examined parameters between the two arithmetic means.

RESULTS

Table 1. Average daily milk production in healthy cows and cows with pronounced symptoms of laminitis

	Healthy cows	Cows with laminitis	Statistical significance
Milk yield (L)	35.85 +/- 2.99	30.015 +/- 5.99	P < 0.05

Table 2. Average daily milk production in cows with pronounced symptoms of laminitis before therapy, 1, 7 and 21 days after therapy

	Before therapy	1 day after therapy	7 days after therapy	21 days after therapy	Statistical significance
Milk yield (L)	30.015 +/- 5.99	29.52 +/- 2.36	-	-	P < 0.01
	30.015 +/- 5.99	-	30.53 +/- 5.72	-	NS
	30.015 +/- 5.99	-	-	34.78 +/- 3.22	P < 0.05
	-	-	30.53 +/- 5.72	34.78 +/- 3.22	P < 0.05

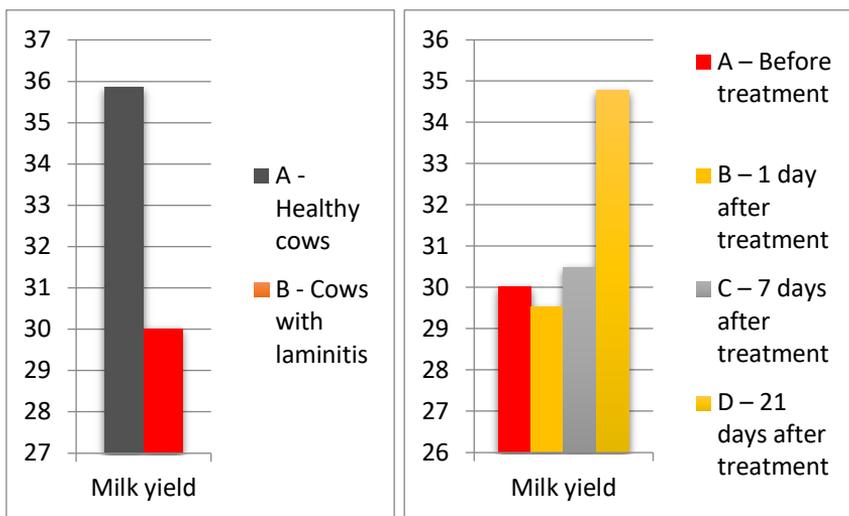


Figure 1. – Milk yield in: healthy cows, cows with laminitis – before treatment, 1, 7, and 21 days after treatment

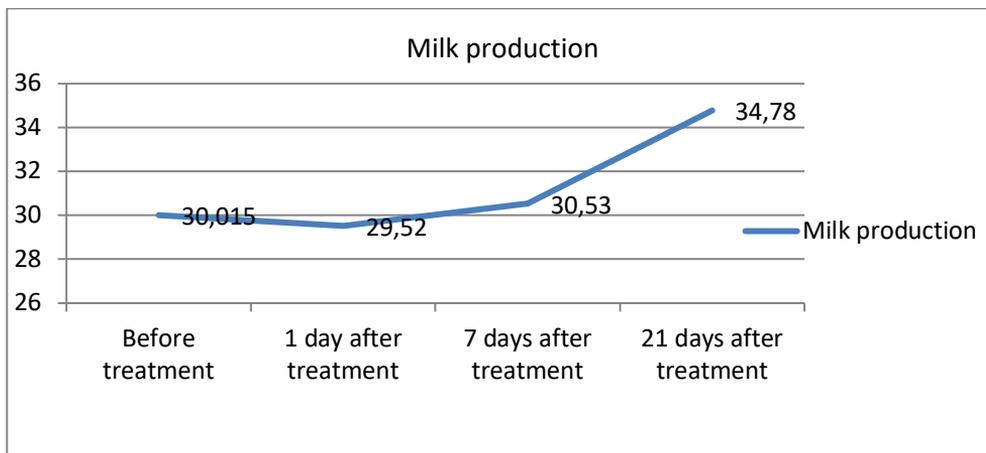


Figure 2. – Milk production in a group of cows with laminitis

DISCUSSION

The lameness in dairy cows is one of the main factors of economic losses on farms (Enting et al., 1997; Kossaihati and Esslemont, 1997). These losses include treatment costs, reduced milk production, reduced fertility, and an increased number of cows excluded from production. Aseptic pododermatitis is a significant disease of high-yielding dairy cows in intensive breeding. This disease leads to a significant decrease in milk production and represents a predisposition to the other diseases' development. Milk production is influenced by various factors: diet, environment, stress, as well as a health condition. Nutrition is one of the key conditions for achieving the highest milk production, so it is very important to fulfill all the factors that affect both appetite and consumption. Lameness in cows is a painful condition that leads to laying down for a long period of time, refusal to move as well as reduced food consumption, which directly affects the decrease in milk production.

Numerous researchers have been involved in quantifying the effect of lameness on milk production. A study done by Greenet et al. (2002) showed that the total reduction in the amount of milk per lactation was 360 kg. Lamé cows produce 0.5 – 1.5 kg less milk per day than healthy cows (Warnick et al., 2001). Rajala-Schultz et al. (1999) and Warnick et al. (2001) also found a decrease in milk production due to lameness. Warnick et al. (2001) found that lame cows, in two herds, produced 0.8 and 1.5 kg less milk per day, 2 weeks after the diagnosis of lameness. Comparing cows with a score of 4 and a score of 1 to 3 (lameness score) in the same herd, they found a reduction of production and presented results of 4.0 and 2.8 kg reduction in the amount of milk per day.

In this study, significantly lower milk production was found in cows with pronounced symptoms of aseptic pododermatitis compared to healthy cows (table 1.). A reduction of up to 4 liters of milk per day has been established. When comparing the amount of milk in

treated cows, an increase in milk production is observed between days 7 and 21 (Figure 2), with a significant difference and a significant increase ($P < 0.05$) in milk only after three weeks of treatment (Figure 1). On the first day after the treatment, a decrease is noticed, which is a consequence of the additional stress to which the cows were exposed during the processing and therapy of the hoofs (Figure 1). In the first 7 days of treatment, a significant increase in the amount of milk was not observed, and the food consumption was not significantly changed (Figures 1 and 2).

CONCLUSIONS

Cows with pronounced symptoms of aseptic pododermatitis have significantly reduced milk production, which represents a significant economic loss. Hoof processing and therapy have a significant impact on the cows' health, consumption, and increased milk production. During the first 7 days after treatment, there is no significant increase in milk production. The greatest exponential increase in milk production is between the 7th and 21st day of treatment, with a significant increase only after three weeks.

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