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# EFFECT OF LAMENESS ON THE BEHAVIOR OF DAIRY COWS UNDER INTENSIVE PRODUCTION SYSTEMS

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## Abstract

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This review is an attempt to systematize and analyze published research to date concerning lameness and its influence on behavior of dairy cows kept in intensive conditions. It was found that lameness affects the behavior of the individual animal's social rank and hierarchy in the herd. Cows with movement problems and found lameness losing position in the food trail, changing his place of rest, losing the position to enter the milking room or visits of milking robot, which changes the whole order of entry for milking. All this reflects on the one hand, their productivity, and the other on their ability to survive in the herd, which requires prompt and adequate measures by farmers to control the problem. Strict control of herd behavior, and welfare and professional attitude of the stockman of animals can provide early indications of real change in health status of cows and it should not be ignored in the choice of technology in modern, intensive dairy cattle rearing.

*Key words:* welfare, herd behavior, social rank, milking parlor, health status

The economical interests of man have a substantial impact on the development of modern dairy cattle husbandry. Today, dairy cattle are reared both on pastures and in contemporary high-technology farms that resulted in changes in their behavior and natural life rhythm. The new rearing conditions led to a number of restrictions in the natural behavior of cattle as they live in a risk environment to an extent that many of them suffer from the so-called technology-related diseases of high-production animals. This required the development of Welfare standards for dairy cattle (1997) from the Royal Society for the Prevention of Cruelty to Animals (RSPCA) aimed at ensuring compliance to minimum rearing standards of dairy cattle. Standards were developed on the basis of the so called Five Freedoms whose observance reduces to a minimum the harmful effect of the environment on biological demands of cattle. One of the five freedoms is the freedom of animals to express their normal behavior. The principal elements of the natural cattle behavior are the ability to move, to turn, to rub up, to feed, to lie down, to ruminate, to hold a stable position in herd hierarchy and

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to adapt to the environment. There are a number of health problems altering the normal behavior, lameness being one of them. According to many studies, once appeared, it has an impact on the general behavior of the animal and hence, on its productivity. This review aimed to systematize and analyze the reports published so far on this subject with the purpose to improve and implement the animal welfare requirements in current production systems providing farm owners and managers with informed choice about lameness as a stressor influencing the behavioral responses in dairy cows.

Cattle are herd animals and thus, exhibit the typical behavior of group living – hierarchy, individual distance, communication etc. The space available is essential for cows' behaviour. The lack of adequate space influences the establishment of the social hierarchy, with low-rank cows being exposed to a permanent stress as they spent significantly less time lying down (Galindo and Broom, 2000). In such cows, according to the authors, lameness is more frequently seen than among leader cows. The limited space available to low-rank cows often causes them making sudden movements to avoid fights with other cows. Very often, cows can slip which results in injury and trauma and consequently, to lameness (Domestic Animal Welfare/Food Quality, Environment and Economics/Sofia, 2010). Nevertheless, the time spent standing is not always indicative about the chance that a cow would become lame or not. In the view of Galindo et al. (2000) cows with clinical lameness spent more time perching in the cubicles than healthy cows. It turns out that lame animals more frequently lose the fights, spend more time lying outside the cubicles, and significantly more time lying down than feeding compared to healthy cows (Galindo and Broom, 2002).

Time spent lying, and hence the hoof health, depend on other factors as well. One of them is the number of cubicles in the farm related to the number of cows. Leonard et al. (1996) provided evidence that an overcrowding of 200% reduced the time spent resting for some cows to 5 out of 24 hours. Such cows are probably low-ranking in the herd hierarchy and later, they develop more severe hoof lesions than cow's leaders which lie down for 7-10 hours a day. High-ranking cows, through aggression and fights, succeeded to find a better place for lying down that is most commonly near to the feed manger and rarely at the end of the row (Gaworski et al., 2003; Cook et al., 2004).

The behavior of cows largely depends on the environment and the comfort it provides. In a series of investigations, we have shown that the time spent resting was 36-53% and mainly (73-90%) during the night (Tossev et al., 1989; Varlyakov, 1989; Varlyakov et al., 1989b, 1993, 2007). Having performed experiments over many years, we concluded that both very low and high temperatures resulted in reduced total duration of rest, but when yards are available, cows preferred them regardless of the season (Varlyakov and Tossev, 1988; Varlyakov et al., 1989a, 1995, 2010a, 2010b). Over the last 30 years, an undesirable trend was established in Bulgaria – the relative proportion of lame dairy cows reared in modern farms has increased. This is a result of numerous reasons, the primary being the sharp decrease of time devoted to individual care. Second comes the supremacy of economic results as a leading criterion when building a plan for cattle health protection. Obviously, the problem could be solved only if action from the national legislative organs to adapt the national legislation to European practices and tendencies is undertaken. Deliberately, the position of the Euro group for Animals, as per November 2010 (What is Euro group calling for? 2010) is "The future CAP should improve animal welfare by direct transfer of funds to farmers to cover animal welfare standards". Similar is the statement of the European Parliament (Resolution from 5 May 2010) which evaluated the Action Plan on Animal Welfare 2006-2010. The Parliament recommended

the EC "... based on new scientific evidence and experience – to compile the action plan for animal welfare 2011-2015 backed by the required funding" (INI/2009/2202).

Cermak (1988) provides detailed information for the effect of cubicle characteristics on the behavior of cows and especially on the use of cubicles with different design by animals. The authors describes in detail the effect of all divider rails on the cows' behavior and the use of cubicles and concluded that cows preferred dry soft cubicles, allowed them to lie down and to get up easily according to the physiological series of movements. The width and length of cubicles should be adequate to the size of cows and this was shown to contribute to good hygiene maintenance and hence, for prevention of mastitis, lameness and injury (Cermak, 1988). Leonard et al. (1994) investigated the effect of boxes with uncomfortable rails that altered the behavior of cows. This cubicle design resulted in reluctance for lying down from the part of cows and this had a negative effect on hoof health. It was also shown that the percentage of cubicle use depended mostly on cubicle design rather than on the type of bedding.

In the scientific literature, the time spent by cows lying down per 24 hours as a part of the rest and its effect on lameness occurrence is extensively researched. A number of studies were carried out to evaluate the comfort of cattle in different production systems and different bedding. The opinions are however still contradictory. In a comparative study on the preferences and the duration of rest of cows on two types of bedding, Norring et al. (2008) established that previous experience was essential for choosing one or another bedding type. The issue of preferences of cows is arguable as according to some authors, cows preferred sand to other beddings (Cook, 2003; Cook et al., 2004). Norring et al. (2008) proved that cows choose bedding familiar to them. Sand was shown to contribute to maintain a better body hygiene despite the shorter time spent lying and thus, the duration of lying down as a factor for prevention or development of lameness was questioned. Investigations on the relationship of cattle behaviour and the amount of bedding showed that cows are able to choose softer surfaces (Tucker and Weary, 2004; Tucker et al., 2009, Mitev et al., 2011). The better comfort and more time spent lying, in the belief of authors, is essential for prevention of hoof lesions.

The advancements of dairy cattle production systems expose animals to a number of influences of various types. Milking parlors and waiting rooms are a part of cows' daily routine that reflects on their behavior. Cook (2008) established that the optimal time that cows spend standing when milked should not be more than 2.8 hours a day. Vokey et al., (2003) recommend that cows should not spend more than 3 hours a day in the milking parlor and the waiting room. The milking parlor size was shown to be important to achieve an optimal time for milking. For herringbone and parallel parlors, the number of animals in the stall could exceed up to 4.5 times the milking parlor places (Smith et al., 2000). Our studies have shown that the critical threshold for stay in the waiting room was 40 min and that it could result in disturbance in milk let-down reflex (Varlyakov and Tossev, 1989, 1992).

According to some researchers (Dickson et al., 1967; Rathore, 1982; Zhekov et al., 2006) cows follow a specific order when entering the milking parlour, and some of them spent a longer time than the average for a milking cycle in the waiting room. We have demonstrated that cows adhered to an order for entering the parlour and its disturbance resulted in loss of milk because of impaired milk let-down reflex both in animals entering first and those entering last for milking. The previous experience of the cow was the major factor influencing the cow entry order for milking (Varlyakov and Sivkova, 1989; Petkov et al., 1999).

We agree with the opinion of Nordlund et al. (2004) that is it more appropriate to measure the time spent by each cow in the waiting room than to register an average time for the herd. It was established that some cows spent 5.7 hours in average in the waiting room and milking parlor in a three-milking schedule in farms where the average daily milking time per cow was normal (3 hours a day). Such cows were probably from the low herd hierarchical ranks and therefore their social position determined their entry order in the parlor. Hassall et al. (1993) stated that lame cows were often slower at entering the milking parlor and thus, very sensitive to milking. According to Cook and Nordlund (2009) this problem is significant in lame and recently calved heifers in large herds reared on pastures. Such cows gathered in the rear part of the waiting rooms and remained there for a much longer time, hence the adverse effect on the health of young animals. The distance to the milking parlor is also a factor influencing the incidence of lameness in cows (Cook, 2008). The author reported about farms where cows had to walk about 700-800 m twice a day on concrete floors to be milked and which had problems with more pronounced hoof horn erosion. Lame cows, according to the author, mover slowly than healthy ones and thus the time during which of the flooring on the way from the stall to the milking parlour exerted its adverse effect on the hooves. This negative effect could be partly reduced by covering the alleys with rubber mats (Vokey et al., 2001). Nevertheless, the continuous walking is a stress for the animal and influences unfavorably udder health (Coulon et al., 1998) resulting in lower milk yields than expected (VanBaale et al., 2005) and poorer reproductive traits (Gergovska, 1992; Gergovska et al., 1992).

It was established that cattle lameness was also a problem in farms supplied with milking robots. The development of lameness or deviations in the normal locomotion of cows resulted in refusal to visit the milking robot and is therefore related to additional labor for milking the cow (Klaas et al., 2003; Bach et al., 2007). According to Bach et al. (2007) young, recently calved heifers were more susceptible to lameness-induced changes in behavior than older cows. The authors observed that lameness did not influence the number of visits on the manger path (in lameness grade III evaluated on a five-score system), but had an impact on the place of diseased animals on the manger path. In lameness of grade higher than III, the number of feedings, dry matter intake and the milk production decreased and so these cows occupy the low ranks of the social hierarchy. Ketelaar-de Lauwere et al. (1996) demonstrated that the herd social hierarchy influenced the visits of cows to the milking equipment. In their opinion, low-ranking cows rarely visited the milking robot and usually spent more time waiting to enter for milking and this, without any doubt, reflected on their hoof health. Low-ranking cows feed for a shorter time (Ketelaar-de Lauwere et al., 1996; Galindo and Broom, 2002) and their dietary dry matter intake is lower (Bach et al., 2007). Galindo and Broom (2002) established that such cows rarely managed to dominate in fights with others and were often pushed away. According to the authors, the adaptation of such animals is more difficult that increased the probability to be culled. Grant and Albright (2001) consider that the competition of animals during feeding could be reduced by proper solutions when groups are formed.

The attitude of animal cares and farmers has also a significant impact on lameness prevalence and the behavior of cows. The relationship between men and animals are essential for animal welfare and the good condition of dairy cows and it is recognized as one of primary factors in the management of cattle farms (Rousing, 2003; Anthony, 2003; Boivin et al., 2003; Rennie et al., 2003). This relationship depends on the conscience of animal careers and their ethics during working and mov-

ing cows along the alleys, which require a careful attitude according the personal level of knowledge. The negative approach of careers induced fear and estrangement of cows from men (Rousing, 2003). According to Seabrook and Wilkinson (2000) the friendly approach of careers exerted a positive effect for earlier detection of diseases in cows, whereas the negative and rude approach of the farm personnel and of the owner itself is preconditions for the higher incidence of lameness in the herd. When cows are urged to move faster along the alleys instead of letting them freely choose the locomotion speed and the place to step upon, they are more likely to develop lameness (Chesterton, 1989; Ward, 1994; Greenough, 1996; Ward, 1999; Ward, 2001). The rough approach ignores the willingness of cows to move at their own speed and to explore carefully the ground. Chesterton (1989) observed that the shorter distance between a man and a cow influenced the prevalence of lameness, especially when sharp objects or slippery surfaces are available on alleys. The approach of the animal carer to cows is not the only one that could have an impact on lameness. Hultgren (2002) believes that farmers do not feel comfortable when they are not able to detect the impaired animal welfare or health problems in cattle, including lameness. The research of Whay (2002) has shown that in average, farmer's detected lameness in less than 25% of the cattle herd before the clinical signs appeared, and according to Webster (2002) the visible lameness is only the "tip of the iceberg".

## Conclusion

Regardless of the conflicting views, it becomes clear that lameness influences the behavior of an animal subject, its social rank in the herd's hierarchy. Cows with lameness and difficulties to move lose their position on the manger path, change their place in the cubicle when resting, lose their position on milking parlor entry or when visiting the milking robot, thus disturbing the entire milking entry order.

All this reflects upon their productivity from one hand, and upon their chance to survive in the herd from the other, therefore requiring rapid and adequate action from farmers to solve the problem. The strict control of herd behavior, the humane and professional approach of the personnel to animals could identify real early indications for disturbed health status of cows and that is why it should be not neglected in the course of production system choice in modern intensive dairy cattle husbandry.

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