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Changes in the hindleg conformation and their relation to lameness, production system and lactation number in dairy cows

Tch. Miteva[1]*, T. Penev[1], Zh. Gergovska[2], J. Mitev[1], N.Vasilev[3], V. Dimova[4]

[1] Department of Applied Ecology and Animal Hygiene, Faculty of Agriculture, Trakia University, 6000 Stara Zagora, Bulgaria
[2] Department of Animal Science, Faculty of Agriculture, Trakia University, 6000 Stara Zagora, Bulgaria
[3] Department of Obstetrics, Reproduction and Reproductive Disorders, Faculty of Veterinary Medicine, Trakia University, 6000 Stara Zagora, Bulgaria
[4] Department of Agricultural Engineering, Faculty of Agriculture, Trakia University, 6000 Stara Zagora, Bulgaria

Abstract. *The study was performed at three dairy cattle farms from three districts in the country: Plovdiv, Bourgas, and Veliko Tarnovo. The cows housed at all three farms were of the Holstein-Friesian breed. A total of 150 cows were included, 50 from each farm. The rearing at the three farms was free with differences in some technological details. The following traits were recorded: hindleg conformation score examined from behind (HLCS), lameness score (LS), body condition score (BCS) of the cows. It has been established that by increasing the age (lactation number), the mean hindleg conformation score increased, respectively from 1.22 at the 1st to 2.29 at the 4th or following lactations. The cows with normal hindleg conformation (HLCS 1) had a mean lameness score of 1.13, which indicated that they did not have any major locomotory problems. The cows with the most considerable hoof overgrowth and change in the leg conformation score (HLCS 3) had the highest lameness score (2.33). The cows without locomotory problems (LS 1) had the highest mean BCS (2.54) compared to those with varying degrees of lameness. The cows with LS 3 had the lowest BCS (1.90). There was a tendency towards a lower extent of fattening in cows with locomotory problems. There were no significant differences in the mean values of HLCS and LS between the three farms, yet there was a difference in the percentages of cows with different scores. The causes can be found in the technological differences of rearing, feeding, etc.*

Keywords: hindlegs conformation, laminitis, body condition score, dairy cows

Abbreviations: LS – Lameness score, BCS – Body condition score, HLCS – Hind legs conformation score

Introduction

Problems with the feet and hooves in cows are a major issue in dairy farms because they lead to considerable direct and indirect losses. Direct losses occur as increased prevention and treatment expenses, as well as culling of animals suffering from chronic lameness. Indirect losses are due to lower milk yield and deteriorating reproductive capacity of the cows (Boettcher et al., 1998). Lameness is often observed in contemporary dairy herds and, apart from a negative economical effect, has an adverse impact on the dairy cows' welfare score. Because of that, easily applicable methods of discovering the signs of lameness at a relatively early stage are sought.

The causes for the occurrence of various leg and hoof problems are various. Many of them are related to the housing conditions (Enevoldsen et al., 1991), while others are inheredited (Boettcher et al., 1998; Manske, 2002). Hoof overgrowth, which mainly pertains to toe's tip and less to the sole and heel, reduces the angle between the front hoof wall and the floor and redistributes a part of the body mass from the toe to the heel of the hoof, which leads to soft tissue damage of the hoof (Rusterholz, 1920; Smedegaard, 1964, Borisov et al., 2010). In this respect, it is fairly logical that cows with overgrown hooves exhibit deviations in their locomotion and leg stance when stepping, compared to cows with normal hooves (Wells et al., 1993; Boelling and Pollott, 1998).

With a base-wide stance caused either by increased udder size (due to milk production or oedema), pregnancy, hard or slippery floor, or a genetic predisposition (Manske, 2002), the soles of lateral hind hooves bear excess weight (Figure 1). As a result of these micro traumas, horn overgrowth occurs as a compensatory mechanism,

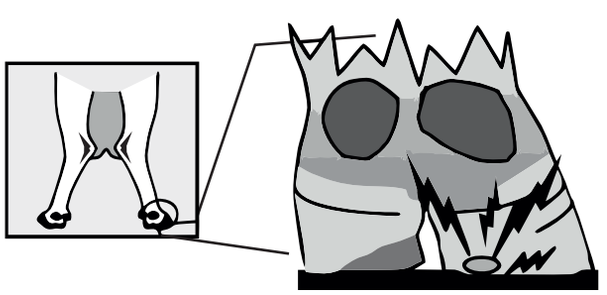

Figure 1. Influence of hoof micro traumas of the hindlegs in dairy cows (Manske, 2002)

* e-mail: kondareva@yahoo.com

causing further changes in the leg's stance (Toussaint Raven, 1973; Greenough, 2007).

According to Blowey, (2008) immediately before and after calving, the cows' udder is considerably enlarged and they have to move by passing their limbs around the udder and step primarily on the medial hoof. This phenomenon can continue in various degrees even up to the middle of lactation, during which time the lateral hoof's horn tissue grows and cows continue to assume that stance even after the udder's volume has decreased after the peak of lactation. Chapinal et al. (2009) also established significant influence of udder size at the onset of lactation on the changes in the way dairy cows walk. An alternative to correcting hoof shape and leg conformation is trimming of the hooves (Toussaint Raven, 1989; Greenough, 2007; Blowey, 2008), which should be done in accordance with the anatomy, claw physiology as well as the animal's individual physiological condition (Borisov et al., 2010).

The goal of the present study is to examine the change in the conformation of the hind legs from a rear perspective at three cattle farms with some differences in the production system technological elements and its relation to lameness score, lactation number and the body condition score of dairy cows.

Material and methods

The study was performed at three dairy cattle farms from three districts in the country: Plovdiv, Bourgas and Veliko Tarnovo. To ensure confidentiality, the farms will be indicated as Farm A, B and C. The cows from all three farms were of the Holstein-Friesian breed. A total of 150 cows were included in the study, 50 from each farm, from the same technological group – lactating cows, first lactation period, from calving up to the 150th day. At the three farms the cows were housed freely with some differences in technological elements.

Description of the applied production system at farms

Farm A. The cows were housed in free groups in a semi-open barn. The cows had a straw-bedded common area for rest and lying. Clean straw was added twice a week and the accumulated bedding material was cleared once a week. The building was divided into two sectors by a longitudinal fence, thus forming two technological groups, feeding from two feeding alleys. Feeding was free with a total mix ration. Milking was two times per day at a herringbone-type milking parlour. Each cow was provided 9 m^2 of indoor area. The mean milk yield of a cow in the examined group was 25.5 kg of milk.

Farm B. Housing was free with individual cubicles within a closed barn. Cubicles were 240 cm of length and 120 cm wide. The cubicle's back board facing the manure alley was 15 cm height. The cubicles were covered with rubber mats with straw bedding and hydrated lime added twice a week. The accumulated bedding was cleared away from the individual cubicles once a week. The technological alleys within the barn were covered with grooved concrete. The premises were cleared with a delta scraper. Daily feeding was free, with a total mixed ration. Milking was three times per day in a herringbone-type parlour. Each cow had allocated area of 7 m^2. The mean daily milk yield from a cow in the tested group was 28 kg.

Farm C. Housing was free with individual cubicles for rest in a closed barn. Cubicle's length was 250 cm, their width 120 cm. A cubicle's backboard facing the manure alley was 25 cm height. The cubicle's floor was covered with a mixture of composted manure and cut straw. The premises were cleared with a delta scraper. Daily feeding was free with a total mixed ration. Milking was three times per day in a herringbone -type milking room. Each cow had allocated area of 7 m^2. The mean daily milk yield from a cow in the tested group was 26.5 kg.There were no yards for the cows to walk around in any of the three farms.

Recorded traits and score systems

Hind legs conformation score (HLCS) from behind was measured through the system suggested by van Amstel and Shearer (2006). With this system, the angle of deviation from the hoof's median line against the body's central axis is assessed. A score of 1 corresponds to normal stance – parallel legs against the body's central axis; score of 2 – deviation of the hooves line at 17º–24º apart of the central axis; score of 3 – deviation of the hooves line of more than 24º apart of the central body axis (Figure 2).

Lameness score (LS) was measured per the adapted system by Penev (2011), which unites the systems of Manson and Leaver (1988) and Sprecher et al. (1997). This system includes 5 degrees, as follows: 1 – healthy cows (the cows stand and walk with a level

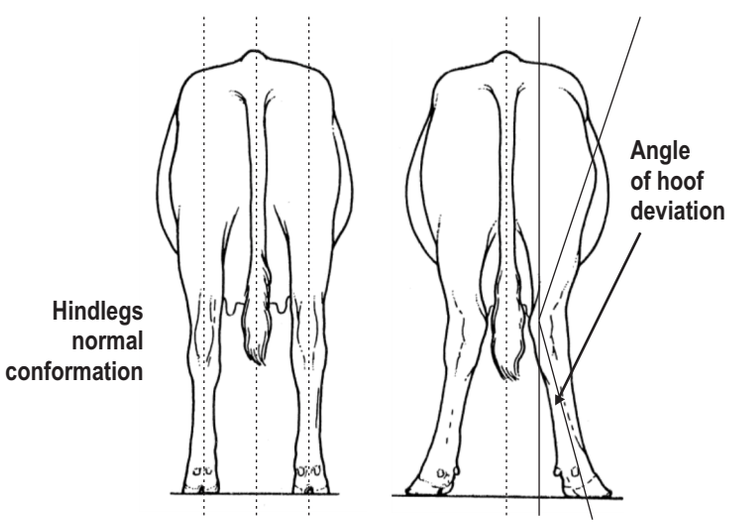

Figure 2. Angle of hoof deviation from the central axis of the body (adapted per van Amstel and Shearer, 2006)

back, walking is normal without visible abduction or adduction of the limbs when moving), whereas a score of 5 is severe lameness (the cow cannot or refuses to bear body weight with one or more of its limbs, feels difficulty when rising or lying down, often walks on three legs). The cows rise in a way similar to horses.

Body condition score (BCS) (body fatness extent) – per Todorov and Mitev (1993). Fatness extent was measured on a 5-degree scale with accuracy of 0.5 points, as follows: 1 – very low, 5 – fat cows. For the purposes of this study, the cows were grouped per BCS as followed: cows with BCS of 2 or less, BCS from 2.5 to 3.5, and BCS of 4 or above points. Measuring the three parameters for the three farms was done during the same season (spring), in March and April 2012.

The data were processed with the respective modules of the STATISTICA 6 software package, and the graphs were prepared with EXCEL.

Results and discussion

With the increase of the cows' age the problems with the hooves and locomotion also increased. Table 1 presents the mean values for the hind leg conformation scores when examined from the rear (HLCS) and lameness score (LS) per lactations. The data clearly indicate a trend towards increasing the mean value of HLCS with age (and lactation) advancement, respectively from 1.22 at I lactation, up to 2.29 at IV and more lactations. This shows that not maintaining the hooves in normal condition with the advancement of age could lead to major changes in the hind legs conformation. This, in turn, reflects on the animals' ability to move freely. In young cows at their I lactation, the average LS was 1.14, showing nearly no problems with movement. In cows at their IV lactation, the average LS was 2.54, indicating that many cows had major problems moving around.

The role of higher milk yield achieved with every next lactation, respectively the change in the hind legs conformation of the cows was proven by Ossent et al. (1987) as well. According to the authors, with the advancement of age, respectively the number of lactations, the load on the lateral hoof from the toe to the heel changes as well as the growth of the hoof horn and the hind legs conformation when viewed from the rear. They also discovered a change in the lateral surface of the hoof in first-time calving cows with the advancement of lactation.

Boelling and Pollott (1998) also found significant influence of the cows' age on all signs related to hoof shape (depth, angle). They also found a significant dependence between lameness and hind legs stance when viewed from the rear. Animal movement deteriorates after the beginning of the barn season, yet stays at a constant level after 10 weeks.

Table 2 presents the mean values for the lameness scores depending on the hind leg stance score. The data show a clear tendency, with the significant differences in all three groups of cows with HLCS of 1 through 3. Cows with normal hind leg conformation (HLCS 1) had mean LS of 1.13 indicating that they don't have locomotory problems. The highest LS of 2.33 were exhibited by the cows with major overgrowth and changes within their hoof conformation HLCS 3.

Boettcher et al. (1998) found high genetic correlation between hind leg stance when viewed from the rear and clinical lameness (-0.68), between the hoof angle and clinical lameness (-0.76), as well as between the width and the rear part of the udder and clinical lameness (0.40). This, as the authors pointed out, indicated that in cows whose hooves are bent away from the body axis have very wide rear parts of the udder and is more prone to lameness.

Table 2. Mean values of the lameness scores depending on the hind leg conformation score.

Hind leg stance score	n	Lameness score*	
		Mean ± SEM	SD
Cows with score of 1	61	1.13 ± 0.044	0.340
Cows with score of 2	65	1.67 ± 0.073	0.589
Cows with score of 3	24	2.33 ± 0.115	0.565

*Significant differences were detected between the three groups of LS at P <0.001

Among the cows with HLCS 1, 57.4% did not have problems walking and 13.1% had slight locomotion deviations (Figure 3). Among the cows with HLCS 3, none walked normally and nearly 30% had serious locomotory problems LS 3 and 4.

We sought a potential relation between body condition score and lameness score (Table 3). The cows without locomotory problems (LS 1) had the highest mean BCS (2.54 points) compared to those with various extents of lameness. The lowest BCS (1.90 points) was exhibited by the cows with LS 3. Only one cow had LS 4 and therefore we won't comment on it. Despite that, a tendency towards a lower fatness extent could be detected in cows with movement problems. This is most likely related to these animals' impossibility to stay standing for a long time to eat.

Figure 4 presents the percentage distribution of cows with different LS depending on their BCS. The best ratio was in the group of cows with BCS 2.5 – 3 points, with 71.6% of them having no problems with movement, the other 28.4% had only slight deviations from normal walking (LS 2). A relatively high percentage of cows with movement problems LS 3 and 4, was observed among the cows with low fatness extent (BCS 2 and lower) – a total of 14.7%. This reaffirms the already stated opinion that movement problems also

Table 1. Mean values for the hind legs conformation score and lameness score during lactation

Farm	n	Hind legs conformation score*		Lameness score**	
		Mean ± SEM	SD	Mean ± SEM	SD
I lactation	36	1.22 ± 0.070	0.422	1.14 ± 0.058	0.351
II lactation	66	1.53 ± 0.066	0.533	1.30 ± 0.057	0.463
III lactation	35	2.29 ± 0.088	0.519	2.11 ± 0.068	0.404
IV lactation	13	2.92 ± 0.077	0.277	2.54 ± 0.183	0.660

*,** Significant differences were detected between all lactations for HLCS P <0.001 and for LS P<0.001

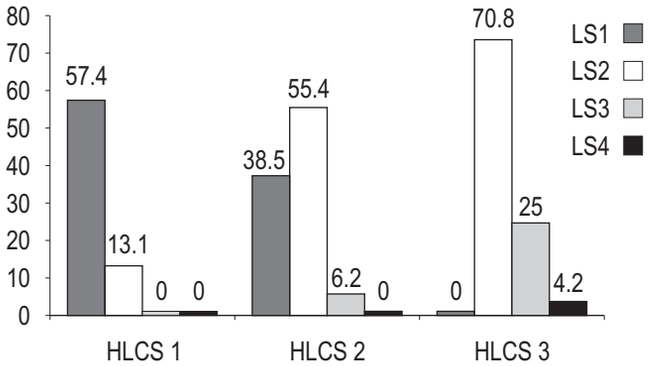

Figure 3. Relative share of the cows depend on locomotion score (LS) by the hindleg conformation score (HLCS)

Table 3. Mean values of BCS depending on the lameness score *

Lameness scores	n	Body condition score*	
		Mean ± SEM	SD
Cows with score of 1	78	2.54 ± 0.057	0.504
Cows with score of 2	61	2.13 ± 0.052	0.407
Cows with score of 3	10	1.90 ± 0.194	0.614
Cows with score of 4	1	1.50	

* Significant differences between BCS in cows with LS1 and LS2 and LS1 and LS3 at P <0.001

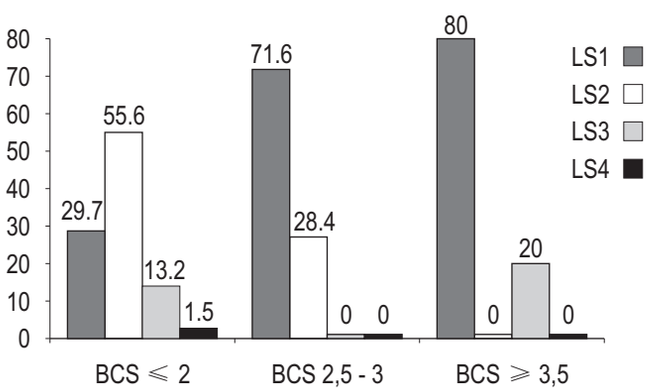

Figure 4. Relative share of the cows depend on BCS by the locomotion score (LS)

reflect on the cows' body condition, affecting their productivity.

Table 4 presents the mean values for the three studied parameters per farms. In the mean values for the hind leg conformation scores (HLCS) and lameness score (LS) there were no significant differences between the cows from the three farms. There were only significant differences in the body condition score (BCS) between the cows from the three farms. The highest mean BCS was exhibited by the cows from Farm B, while the lowest was in Farm A, with the differences being significant between Farm B and the other two farms.

Even though there were no significant differences in the mean values of HLCS and LS, differences in the percentages of cows with different scores were observed between the three farms. Farm B had the highest relative share of cows with HLCS 3 – 18%, which also had the lowest share of cows with normal hind legs stance HLCS 1 36% (Figure 5). This ratio was the best among the cows in Farm B – cows with HLCS 1 – 46% and HLCS – 12%. In all three farms, however, the total share of cows with HLCS 2 was above 50%. This indicated that better attention towards cows' hooves, with regard to their timely trimming, had to be paid at all three farms.

Van Amstel and Shearer (2006) pointed out that when less than 40% of the cows had score of 1; more than 20% had scores > 3, or more than 50% of the cows had scores of 2 and 3, that would indicate that their hooves need trimming.

Regardless of the observed unfavorable ratio of cows with HLCS at Farm C, it also had the highest percentage of cows without locomotory problems (LS 1), as well as an absence of cows with major problems – LS 4 (Figure 6). A cow with LS 4 was found at Farm B, yet the total share of cows with serious movement problems LS 3 and 4 was lower than the values in the other two farms, even if by an insignificant extent – a total of 6% versus 8%.

All this indicated that causes for lameness were not limited to hoof overgrowth. Causes could be found in the technological differences in feeding and housing the cows. At Farm A, the cows were kept free on thick straw bedding, at Farm C the boxes also had soft bedding made of composted manure and straw, which reduced hoof trauma while the cows stood or walked around. At Farm B the cubicles were covered with rubber mattresses and hydrated lime and straw.

The discovered significant differences between the mean BCS of the cows from the three farms reflected on their distribution in % per BCS (Figure 7). The best distribution of cows per BCS was measured at Farm C. The greatest share of the cows had BCS of 2 to 3 points, which is the desirable body condition for cows at the onset of lactation, when the other studied parameters were measured. Only 6% had BCS below 2 points and 4% over 3 points. At the other two farms there were a relatively high percentage of cows with BCS of 1.5, respectively 20% and 14% for Farms A and B. This was, to a great extent, related to the measured LS in these two farms. The presence of a greater relative share of cows with movement problems was related to the higher percentage of cows with lower BCS.

Table 4. Statistical data on the examined parameters per farms *

Farm	n	Hind leg conformation score		Lameness score		Fatness extent score	
		Mean ± SEM	SD	Mean ± SEM	SD	Mean ± SEM	SD
Farm A	50	1.76 ± 0.101	0.716	1.58 ± 0.091	0.642	2.22 ± 0.074	0.526
Farm B	50	1.66 ± 0.097	0.688	1.56 ± 0.095	0.675	2.27 ± 0.079	0.564
Farm C	50	1.84 ± 0.104	0.738	1.54 ± 0.091	0.646	2.50 ± 0.062	0.440

* Significant differences were detected only for BCS – between BCS for Farm A and Farm C at P <0.001 and between Farm B and Farm C at P <0.05.

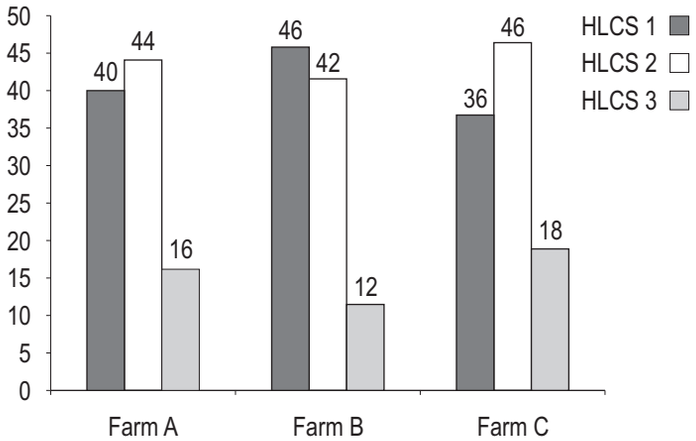

Figure 5. Relative share of the cows depends on hindleg conformation score (HLCS) by farms

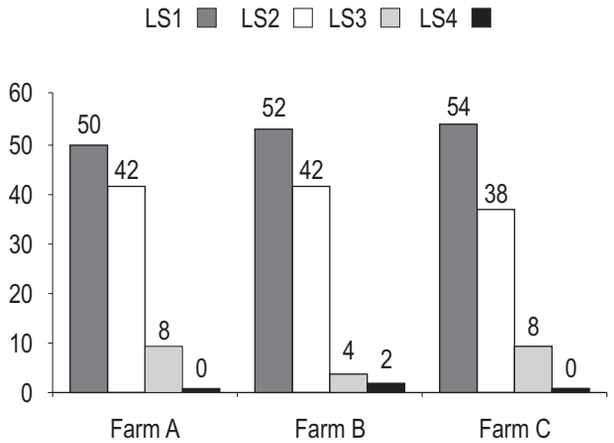

Figure 6. Relative share of the cows by farms, depend on the locomotion score (LS)

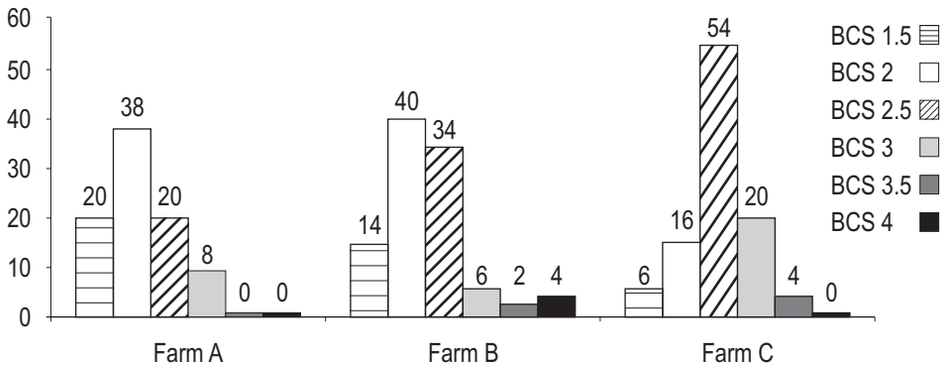

Figure 7. Relative share of the cows by farms, depend on body condition score (BCS)

Conclusion

There was a clear tendency towards increasing the mean value of HLCS with the increase in age (and lactation number), respectively from 1.22 at I lactation to 2.29 at IV or subsequent lactations. The cows with normal hind leg conformation (HLCS 1) had average LS of 1.13, which indicated that they did not have major movement problems. The highest LS (2.33) were exhibited by the cows with major hoof growth and changes in the leg stance, HLCS 3.

Cows without movement problems (LS 1) had the highest mean BCS (2.54 points) compared to those with various degrees of lameness. The cows with LS 3 had the lowest BCS (1.90 points). There was a tendency towards lower fatness degrees in cows with movement problems.

There were no significant differences in the mean values of HLCS and LS between the three farms, yet there were differences in the percentages of cows with different scores. Farm C had the highest relative share of cows with HLCS 3 (18%), and it also had the lowest share of cows with normal hind leg conformation HLCS 1 (36%). The best ratio of cows was in Farm B. Farm C had a high percentage of cows without movement problems (LS 1), as well as no cows with serious problems – LS 4. All of this indicated that the causes for lameness were not limited to hoof overgrowth. Causes can be found in the different breeding technologies, cow feeding, etc.

References

Blowey R, 2008. Cattle Lameness and Hoofcare, Old Pond Publishing Ltd; ISBN 978-1-905523-28-3, 135.

Boelling D and Pollott GE, 1998. Locomotion, lameness, hoof and leg traits in cattle I. Phenotypic influences and relationships. Livestock Production Science 54, 193-203.

Boettcher F, Dekkers J, Warnick L and Wells S, 1998. Genetic analysis of clinical lameness in dairy cattle. Journal of Dairy Science, 81, 1148-1156.

Borisov I, Mitev J, Ganchev G, Dimitrova D, Chaprazov Tz and Penev T, 2010. Hoof diseases and disorders of productive animals (podology), ISBN 978-954-9443-38-7, 121.

Chapinal N, De Passille A and Rushen J, 2009. Weigh distribution and gait in dairy cattle are affected by milking and late pregnancy. Journal of Dairy Science. 92, 581-588.

Enevoldsen C, Grohn Y, and Thysen I, 1991. Sole ulcers in dairy cattle: associations with season, cow characteristics, disease and production. Journal of Dairy Science, 74, 1284-1298.

Greenough P, 2007. Bovine Laminitis and Lameness, Elsevier Limited; ISBN-13: 978 0 7020 2780 2, 311.

Manske T, 2002. Hoof lesions and lameness in Swedish dairy cattle. Prevalence, risk factors, effects of claw trimming, and consequences for productivity. University of Agricultural Sciences, Skara, Sweden. Thesis for PhD, ISSN 1401-6257; ISBN 91-576-

6390-4, 68.
Manson FJ and Leaver JD, 1988. The influence of concentrate amount and clinical lameness in dairy cattle. Animal Production, 47, 185-190.
Ossent P, Peterse DJ and Schamhardt HC, 1987. Distribution of load between the lateral and medial hoof of the bovine hind limb. The Journal of Veterinary Medical Science 34, 296.
Penev T, 2011. Lameness scoring systems for cattle in dairy farms (review). Agricultural Science and Technology, 3, 4, 291-298.
Rusterholz A, 1920. Das spezifisch-traumatische Klauens-ohlengeschwür des Rindes. Schweizer Archive für Tierheilkunde 62, 421-446, 505-552 (Ge).
Smedegaard HH, 1964. Contusion of the sole in cattle. The veterinarian 2, 119-139.
Sprecher DJ, Hostetler DE, and Kaneene JB, 1997. A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. Theriogenology, 47,1178-1187.
Todorov NA and Mitev JE, 1993. Body condition score in dairy cows; ISBN 954-8379-03-1, MIT publishing house, Stara Zagora, 24.
Toussaint Raven E, 1973. Lameness in cattle and foot care. Netherlands Journal of Veterinary Science 5, 105-111.
Toussaint Raven E, 1989. Cattle Foot Care and Claw Trimming. Farming Press, Ipswich, UK. ISBN 100852361491, 127.
van Amstel S and Shearer J, 2006. Manual for Treatment and Control of Lameness in Cattle. Blackwell Publishing, 212.
Wells SJ, Trent AM, Marsh WE and Robinson RA, 1993. Prevalence and severity of lameness in lactating dairy cows in a sample of Minnesota and Wisconsin dairy herds. Journal of the American Veterinary Medical Association 202, 78-82.

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Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows,IXth International Conference on Production Diseases in Farm Animals, Sept.11 – 14, Berlin, Germany, p. 302 (Abstr.).

Thesis:

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