

Body condition related to lameness in dairy cows

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Summary

The objectives of the present study were to assess the association between body condition and lameness throughout lactation and dry period in Polish Holstein-Friesian cows and in their crosses with the Jersey breed, as well as to evaluate the correlation between body condition scores and lameness scores. The study is based on data from 68 cows. The cows were housed in tie stalls with access to a pasture and a cow yard throughout the year. Cows were scored for lameness (score 1-5) by the same experienced observer once a month for 8 months (from March to October 2009). Concurrently, cows were scored for body condition on a 1 to 5-point scale with 0.25-unit increments. Compared with non-lame cows, clinically lame cows were characterized by losses of body condition throughout lactation, particularly in early, medium, and late lactation. In the dry period the body condition was similar for lame and non-lame cows. The losses in the body condition score were larger for crossbred cows (Polish Holstein Friesian × Jersey) than for the Polish Holstein-Friesian cows. This study shows a significant relationship between the body condition score and the lameness score in dairy cows ($r = -0.22$).

Keywords: dairy cows, body condition score, lameness score

Body condition scores (BCS) can be a good management tool, which is used to monitor the amount and mobilization of body adipose tissue and thus indicates a negative energy balance (NEB) of cows in early lactation (4). This method of body condition scoring is based on a visual and tactile appraisal of body fat reserves in the back and pelvic regions and BCS is usually performed on a 1- to 5-point scale (28). Previous studies showed that BCS at calving and body condition loss in early lactation are related to health, fertility, and milk yield (1, 8-10, 13, 15, 17, 23). However, the literature presents limited data relating BCS at calving to early lactation lameness. Clinical lameness (CL) is caused mainly by sole ulcers, white line diseases, interdigital necrobacillosis, and digital dermatitis (2, 16). A literature review shows the negative effects of lameness on cattle's health and production (11). BCS reduction in the postpartum period is associated with BCS status during lactation, and often leads to a higher incidence of reproductive disorders and lameness, and to a higher culling rate, as well as to a lower reproductive performance (10, 19, 20). Few authors report positive associations between BCS and lameness (8). Cows with BCS > 4 in the dry period were 7 times more likely to develop foot problems in the subsequent lactation. However, this potential association is ambiguous, since this effect can be a result of BCS per se, or the cows may obtain a given BCS as a consequence of feeding

(laminitis is associated with excessive feeding in the dry period). The results of other studies show no positive association between BCS at precalving, at calving or in early lactation and the incidence of lameness (1, 9, 10, 15, 24). Conversely, those authors report a negative relationship between calving and early lactation BCS and lameness: cows with BCS < 3 at calving were more likely to become lame. However, these results are also ambiguous, as it is unclear whether it was the low BCS that caused lameness, or lameness caused a lower BCS through a reduced dry matter intake in early lactation. Other researchers report that BCS and parity of cows have been associated with a prevalence of lameness (8, 10, 22, 27). However, BCS was affected by parity and days postpartum, with an interaction between both effects (18). Improved locomotion and higher BCS in the postnatal period could improve reproductive performance in high-producing dairy herds (29). Older cows are more prone to become lame than young cows, and poor body condition is not only a risk factor for lameness, but also has negative economic and welfare implications (22). The data presented in some studies suggest a strong correlation between poor body condition and clinical lameness (2, 3, 27). In modern farms in Austria, with herd sizes above 30 cows, lying comfort and nutrition are key areas for lameness prevention (5).

The objectives of the present study were to assess the association between body condition and lame-

ness throughout lactation and the dry period in Polish Holstein-Friesian cows and their crosses with the Jersey breed, as well as to evaluate the correlation between body condition scores and lameness scores.

Material and methods

Herds. The study was conducted on Polish Holstein-Friesian dairy cows ($n = 49$) and crossbred Polish Holstein-Friesian and Jersey cows ($n = 19$) kept on a farm located in the Wielkopolska region. The cows were housed in tie stalls with access to a pasture and a cow yard throughout the year. The average milk yield for approximately 250 cows, per cow in the herd, was 8,054 L/yr. Cows were milked in the tie stalls to a pipeline. The substrate in the cow yard was not hardened (threshing floor). The barn was not equipped with pools for preventive foot baths. For study purposes, the data were collected between March and October 2009 from cows that calved for the second time from December 2008 to December 2009. From March to October, 8 out of 68 cows observed (11.8%) were culled because of metabolic disorders, udder disorders, barrenness, or post-natal complications. In the summer period, cows were fed as follows: pasture from 8.00 in the morning up to 1.00 in the afternoon, feeding with a total mix ration (15 kg corn cob silage, 8 kg beet pulp – 24% dry matter, 6 kg lucerne haylage, 5 kg grass haylage per day per cow). In addition, cows received 8 kg of fresh green lucerne fodder per day per cow. After calving, cows were additionally fed a concentrate (7 kg/day/cow). Every day, new bedding was supplied in the tie stalls before cows returned from pasture. Claws of clinically lame cows were disinfected with Bioval (Biovet Drawalew SA) and treated with an antibiotic spray. Hoof trimming in the herd was performed twice a year, in November and April.

Lameness and body condition scoring. The animals were scored for lameness (score 1-5) by the same experienced observer once a month for 8 months (from March to October 2009). The scores, based on gait and posture while walking and standing, were given by the methods suggested by Sprecher et al. (25). Cows were classified into one of the five categories of lameness: 1 – non-lame (normal gait), 2 – mildly lame, 3 – moderately lame, 4 – lame, and 5 – severely lame. Cows which scored ≥ 3 points were classified as clinically lame (CL). Concurrently, cows were scored for body condition on a 1- to 5-point scale (where 1 = emaciated to 5 = extremely fat) with 0.25-unit increments, using an established method by Wildman et al. (28).

Data collection. The following data were collected from the farm records for each cow: second calving date, dry date before the second parity, days from second calving to the day of BCS and lameness scoring, or days from the dry date to the day of BCS and lameness scoring. Every month the same cows were evaluated, but their physiological status changed (progress

of pregnancy, lactation period, dry period). Altogether, 506 observations were recorded for lameness and body condition. The list of results collected was divided in terms of the days of progressing lactation (approx. every 60 days) and cows in the drying-off period. Differences in the BCS of cows were tested between periods of lactation or the dry period in both groups of cows: the clinically lame (scores ≥ 3) and the non-lame (scores ≤ 2).

Statistical analysis. Data analysis was performed with the Statistica statistical package (Version 8). The statistical analysis of the results consisted of the two-way analysis of variance (ANOVA). The main factors considered in the analysis of variance included BCS in different lactation periods of clinically lame and non-lame cows, and the breed group (Polish Holstein and Polish Holstein crossbred with the Jersey breed). Significant differences between means were considered those at $P < 0.05$ and $P < 0.01$. The one-way analysis of variance was applied to evaluate significant differences between the BCS of cows within different categories of lameness. Also Pearson's correlation coefficient was calculated between the BCS of cows and their lameness scores.

Results and discussion

Sample characteristics. The means of the traits are presented in Tab. 1. The mean BCS was 3.43, with BCS values ranging from 1.75 to 4.75 points. A similar mean BCS was recorded in the lactation period, and it was higher in the dry period. Means for the locomotion score in the lactation period (1.41 ± 0.80) were higher than those in the dry period (1.16 ± 0.54). The mean BCS, standard deviation, and the range of BCS values were similar to those reported by some authors (1). For 501 lactating dairy cows the values of BCS were lower (2.7 ± 0.39) and the locomotion scores were much higher (2.3 ± 0.8) compared with the results of this study (2). Pryce et al. (21) reported that BCS was on average 2.63 in the first week after calving, dropping to 2.39 by the tenth week after calving.

Body condition scores of lame and non-lame cows. Body condition scores of clinically lame and non-lame cows in the course of lactation are given in Table 2. Non-lame cows had higher body condition scores compared with clinically lame cows in each lactation

Tab. 1. Means, SDs, minimum values, and maximum values for locomotion score and body condition score

Traits	Observations (n)	Means	SD	Minimum	Maximum
Lactation period					
Locomotion score	442	1.41	0.80	1	4
BCS	442	3.42	0.38	1.75	4.75
Dry period					
Locomotion score	64	1.16	0.54	1	3
BCS	64	3.56	0.38	2.75	4.75
Total					
Locomotion score	506	1.39	0.79	1	4
BCS	506	3.43	0.38	1.75	4.75

Tab. 2. Body condition score of lame and non-lame cows throughout lactation and dry period

Lactation period		Body condition score			
range (days)	$\bar{x} \pm sd$	n	clinically lame cows	n	non-lame cows
1-60	30 ± 19	10	3.45 ± 0.34	70	3.35 ± 0.34
62-122	92 ± 18	8	3.09 ± 0.19 ^a	68	3.38 ± 0.41 ^a
124-182	152 ± 16	8	3.22 ± 0.16	58	3.45 ± 0.47
184-242	210 ± 17	11	3.09 ± 0.26 ^A	63	3.51 ± 0.44 ^A
244-300	269 ± 26	7	3.11 ± 0.28 ^a	53	3.40 ± 0.26 ^a
303-516	369 ± 47	6	3.33 ± 0.41	80	3.55 ± 0.29
Total in lactation period		50	3.21 ± 0.33 ^A	392	3.44 ± 0.38 ^A
Dry period					
21-90	30 ± 21	5	3.55 ± 0.21	59	3.56 ± 0.39
Breed group*					
1	177 ± 128	42	3.31 ± 0.32	320	3.39 ± 0.34
2	143 ± 108	13	3.02 ± 0.30 ^A	131	3.63 ± 0.41 ^A
Total observations		55	3.24 ± 0.33 ^A	451	3.46 ± 0.38 ^A

Explanations: * 1 – Polish Holstein-Friesian (PHF), 2 – PHF × Jersey crosses; A (a) – means in the same rows followed by identical letters are different at $P < 0.01$ ($P < 0.05$)

period. Statistically significant differences in body condition between the two groups of cows were found in early, medium, and late lactation. Such differences were also observed in the mean condition of clinically lame and non-lame cows throughout the entire period of lactation. In the dry period, BCS was similar in cows of both groups. Apparently non-lame Polish Holstein-Friesian cows had slightly higher BCS compared with clinically lame cows of this breed, but this difference was not significant, whereas that between the BCS of clinically lame and non-lame cows in the crossbred group was statistically significant.

In the previously study, it was shown that high genetic merit cows had a lower BCS and body condition loss in early lactation than do average merit cows (21). BCS decreased during early lactation, it was maintained during mid-lactation and reached a nearly steady state during late lactation (10, 22, 23). Those authors suggest that BCS is strongly related to the stage of lactation, and changes in BCS during lactation are significantly affected by parity and dairy merit of cows.

The body condition score was related to the prevalence of lameness (6). The prevalence of CL in a group of under-conditioned cows ($BCS \leq 2.5$) was greater than the mean prevalence observed for normal ($BCS \geq 2.75$ and ≤ 3.5) and over-conditioned cows ($BCS \geq 3.75$). Those authors did not find differences between normal and over-conditioned cows. The results of our study indicate that

the BCS of cows with CL was lower in each analyzed lactation period compared with that of non-lame cows, and significant differences between the two groups of cows were found in early, medium, and late lactation. A deterioration in body condition could be a consequence of the disability in locomotion, causing a reduced feed intake. Lame cows have a shorter time of fodder consumption, and they also eat slowly because of the restriction of movement (12). Similarly, lame cows have a reduced grazing time. Some authors, however, did not find any differences between lame and non-lame cows in the total time spent eating (7). Recent studies also show a negative relationship between calving and early lactation BCS and lameness (10). According to those authors, lameness diagnosed postpartum was connected with a lower BCS at calving, as well as 4 and 10 weeks postpartum. Cows

with a lower BCS status, as well as high-parity cows, generally had a distinctly higher risk of being lame (15, 22, 24).

Walker et al. (26) report that a bigger number of lame cows had a low BCS (10/39 lame, 0/20 non-lame; $P = 0.013$), and lame cows had a lower bite rate while grazing than non-lame cows. Cows that were over-conditioned at drying off were more likely to develop foot problems in the next lactation than cows in good condition (8). Those authors suggest that body condition loss during the antepartum period affected the BCS status during lactation. This was associated with a higher incidence of reproductive disorders and lameness, as well as a higher culling rate, and resulted in a lower reproductive performance. The differences in BCS between clinically lame cows and non-lame cows at calving were non-significant (8). BCS at calving was unrelated to reproduction, whereas BCS loss was a significant predictor of reproductive performance (22).

Association between lameness score and body condition score. The mean BCS values in relation to successive lameness scores are shown in Table 3. For BCS values the average number of days was given,

Tab. 3. The relationship between lameness scores and body condition scores

Lameness score	Observations (n)	$\bar{x} \pm sd$ (days)	Body condition score	Pearson's correlation coefficient between lameness score and body condition score
1	383	176 ± 128 ^A	3.49 ± 0.37 ^{ABC}	
2	68	132 ± 107 ^A	3.30 ± 0.40 ^A	
3	34	145 ± 101	3.24 ± 0.34 ^B	
4	21	169 ± 115	3.25 ± 0.32 ^C	
1.39	506	168 ± 124	3.43 ± 0.38	-0.22

Explanations: A, B, C – means in the same column followed by identical letters are different at $P < 0.01$

and significant differences between days in lactation were observed only between non-lame and mildly lame cows ($P < 0.01$). The mean BCS of non-lame cows was higher than the mean BCS of mildly lame, moderately lame, and lame cows ($P < 0.01$). An increase in lameness scores was associated with a decrease in the body condition score. Pearson's correlation coefficient between the lameness score and the body condition score was -0.22 . Calculated genetic correlations between dairy form and BCS range from -0.72 in the United States (3) to -0.61 in Denmark (14). Low BCS and high dairy form were also genetically correlated with an increase in the incidence of metabolic diseases and poorer cow health (4). High milk yields and low body condition were correlated with foot and leg conformation, which could significantly predispose cows to foot and leg disorders (3). Moreover, NEB plays a considerable role in the relationship between BCS, dairy form, and foot and leg diseases (4). A high dairy form and a low BCS were associated with the leg side view and foot angle, as such cows tend to have more set to their hock and slightly lower foot angles (3). Those results confirm the data from this study, which suggest that the BCS of cows decreases with the value of lameness scores. Pearson's phenotypic correlations between lameness scores and body condition scores calculated in this study were statistically significant (-0.22). Wells et al. (27) also found a strong correlation between poor body condition and clinical lameness. Those authors explained that the loss of body weight can be a result of lameness, and not a causative factor for lameness.

In conclusion, compared with non-lame cows, clinically lame cows were characterized by losses in body condition throughout lactation, particularly in early, medium, and late lactation. In the dry period the body condition of lame and non-lame cows was similar. The loss in body condition score was larger in the crossbred cows (Polish Holstein-Friesian \times Jersey breed) than in the Polish Holstein-Friesian cows. In this study, a significant relationship was found between the body condition score and the lameness score in dairy cows ($r = -0.22$).

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