Body Condition Scoring in Holstein Dairy Cows: Relationships with Production, Reproduction, and Disease

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Abstract

An observational study of 429 Holstein dairy cows in 13 herds in Prince Edward Island, Canada was performed to determine the relationship among body condition score (BCS) and changes in BCS with milk production, reproductive performance, and disease. All Holstein dairy cows that calved between 1 March 1991 and 1 November 1991 were enrolled in the study. Cows were body condition scored once during the dry period, near claving, and then every 14 days until termination of lactation. All body condition scoring was performed by one person using a 1-5 scale with quarter-point divisions.

Factors examined were: the effect of BCS at calving on either peak milk yield or 305-day milk yield; condition loss during the postpartum period; total amount of gain affected by condition score at calving or production level; differences in number of breedings, days to conception, days to first heat, or days to first breeding for cows grouped by body condition score at calving or cows grouped by amount of condition loss; the rate of disease diagnosis for cows with different BCS. The results of this work and the ramifications for dairy practitioners, will be discussed in this presentation.

Introduction

Body condition scoring is a subjective method of evaluating the energy reserves of dairy cows. Various methods of body condition scoring are in use throughout the world. Body condition scoring methods have been validated using ultrasonic fat measurements and dissection studies. The relationship among body condition score, changes in body condition score, milk production, reproductive performance, and disease incidence is not well defined. The objective of this study was to determine the relationship between body condition score and changes in body condition score with milk production, reproductive performance, and disease incidence in Holstein dairy cows.

Materials and Methods

Data

The data were comprised of 429 lactations of Holstein cows in 13 nonrandomly selected dairy herds in Prince Edward Island, Canada. All cows that calved between 1 March 1991 and 31 October 1991 were eligible for the study. Lactations were completed by death, removal from the herd, dry off, or attainment of 305 days in milk (DIM). Cows that were culled prior to milking for 80 days were excluded from analysis. Of 465 eligible cows, 36 were excluded from the final data analysis.

Each participating farm was visited by a technician every two weeks from late February 1991 until October 1992. Cows were body condition scored once during the dry period, after calving, and then every 14 days until termination of the lactation or until they reached 305 DIM. All body condition scoring was performed by one person, and a BCS chart was consulted for each cow. BCS at calving (BCS1) was defined as the first BCS obtained after the cow had calved. Minimum BCS (MINBCS) was defined as the lowest BCS obtained during the lactation. BCS loss (LOSS) was defined as the difference between BCS1 and MINBCS. BCS gain (GAIN) was defined as the difference between the last BCS prior to termination of the study lactation or prior to 305 DIM and the MINBCS. Production data were obtained and milk yields were converted to 4% FCM. Peak milk production per cow (PEAK) was defined as the highest test day milk weight.

Data Analysis

To account for the among-herd differences, HERD was included as a random variable in all statistical models. The SAS general linear models (GLM) procedure ANOVA was used to determine differences in outcome variables (LOSS, GAIN, PEAK, 305-day 4% FCM yields (FCM305)) and reproductive statistics for cows that were grouped by body condition score, and production. The same procedure was used to analyze differences in BCS based upon disease diagnosis.

Results and Discussion

Descriptive Results

The herds included in this study were small by North American standards but were typical of Prince Edward Island dairy farms (Table 1). A total of 130

Table 1. Descriptive statistics for data from 429 Holstein lactations in 13 herds in PEI Canada.

	No. Cows Herd	No. Inc. stud	LACT No.	Days Dry (N)	BCS1[a] pts (N)	LOSS[b] pts (N)	GAIN[c] pts (N)	PK1[d] kgs (N)	PK2+[e] kgs (N)	FCM305[f] kgs (N)
Mean	49.3	33	3.04	71	3.23	.80	.53	25.7	35.7	7225
SD	20.5	15.6	2.05	35	.42	.36	.32	4.3	6.4	1379
MIN	35	17	1	12	2.00	0.00	0.00	13.8	20.6	3748
MAX	113	81	12	249	4.50	2.00	1.75	36.9	57.2	11709
Total	641	429	429	284	428	429	429	130	299	332

[a] 1st BCS postcalving
[b] BCS1 - Lowest BCS during lactation
[c] Condition gain during 305-day lactation after reaching lowest BCS
[d] Peak test-day milk weight for primiparous cows
[e] Peak test-day milk weight for multiparous cows
[f] 305-day 4% fat corrected milk yields

Table 2. Body condition LOSS, GAIN and MINBCS for Holstein dairy cows in 13 PEI herds grouped by BCS at calving.

BCS at Calving	LOSS (SE)[1] points [N]	GAIN (SE)[1] points [N]	MINBCS[2] points [N]
≥ 4.00	1.23 (.06)[a] [30]	.57 (.06)[a] (30)	2.89 (.06)[a] (22)
3.50 - 3.75	1.00 (.03)[b] [108]	.51 (.03)[a] (108)	2.56 (.03)[b] (84)
3.00 - 3.25	.81 (.02)[c] [213]	.51 (.02)[a] (213)	2.35 (.02)[c] (164)
< 3.00	.49 (.04)[d] [77]	.58 (.58)[a] (77)	2.16 (.04)[d] (62)

[1] adjusted for HERD
[2] adjusted for HERD and FCM305
[a,b,c,d] Means in the same column with no common superscripts differ (*P* < .05)

Table 3. Body Condition LOSS and GAIN for 333 Holstein dairy cows in 13 PEI herds grouped by lactational milk yields.

FCMGROUP	N	FCM305 kg	LOSS (SE)[1] points	GAIN (SE)[1] points	MINBCS[1] points
≤6000 kg	70	5460	.68 (.04)[a]	.58 (.04)[a]	2.58 (.05)[a]
>6000 – ≤7000 kg	83	6490	.81 (.04)[b]	.58 (.03)[a]	2.49 (.04)[a]
>7000 – ≤8500 kg	114	7666	.86 (.03)[b]	.60 (.03)[a]	2.34 (.03)[b]
>8500 kg	66	9247	.94 (.04)[b]	.56 (.04)[a]	2.23 (.05)[b]

[1] adjusted for HERD
[a,b] Means in the same column with no common superscripts differ (*P* < .05)

primiparous and 299 multiparous cows were included in the final data set. Average FCM305 was 6391 ± 1083 kg and 7611 ± 1332 kg for 105 primiparous and 227 multiparous cows respectively. Body condition scores were obtained during the dry period (DRYBCS) for 226 multiparous cows at 20 ± 11 days prepartum. Body condition scores at calving were obtained at 7 ± 4 days postpartum. The DRYBCS (3.48 ± .42) was significantly different from BCS1 (3.23 ± .42) (t = 7.23; 652 df; P < .0001). It is unlikely that the variation between DRYBCS and BCS1 can be attributed to differences in scoring technique. All scoring was performed by one person following a strict protocol, and scoring of dry cows and postpartum cows was performed throughout the study. Energy balance is most negative during the first postpartum week. The rate of condition loss is greatest in the immediate postpartum period, and the .25-point difference may reflect rapid tissue mobilization that occurred prior to obtaining the first post-calving BCS.

Statistical Analysis

Condition Change

Cows that calved with higher BCS1 (≥ 3.50) appeared to lose condition for a longer period of time as compared to cows with lower BCS1 (≤ 3.25). Cows that calved with BCS of ≤ 3.25 reached their MINBCS by about 50 DIM, but cows that calved with BCS > 3.25 reached their MINBCS about a month later. Cows that calved with higher BCS lost more condition (Table 2). GAIN was not affected by BCS at calving (Table 2). After reaching MINBCS, the rate of gain appeared to be uniform among BCS1 groups. Cows in the higher BCS1 groups did not regain the condition that they had lost within the 305-day study lactation. Cows that calved with BCS1 < 3.00 gained more condition in the 305-day period of this study than they had lost.

Cows in the lowest production group lost less condition than cows in the higher production groups, primarily because they appeared to lose condition for a shorter period of time (Table 3). There was no difference in BCS loss among the other three production groups. Gain was not affected by production group.

When the effects of BCS1 and FCM305 were combined in a single analysis, there were significant among-group differences in LOSS but no difference in the amount of GAIN (Table 4). BCS at calving appeared to have a larger effect on amount of condition loss than production level. Cows with BCS1 ≥ 3.50 lost the most condition regardless of production. There was no difference in MINBCS based upon production for cows with BCS1 ≥ 3.50. Cows with BCS1 ≤ 3.25 that produced more milk experienced more condition loss and consequently had lower MINBCS as compared to cows with lower milk production. For the first 35 DIM, production group had no effect on condition score for cows that calved with

Table 4. Body Condition LOSS and GAIN for 332 Holstein dairy cows in 13 PEI herds grouped by body condition score at calving and total lactational milk yields

Group	BCS1	FCM305	N	LOSS(SE)[1] points	GAIN(SE)[1] points	MINBCS[1] points
HH	≥3.50	>7000 kg	52	1.13(.04)[a]	.58(.04)[a]	2.56(.04)[a]
HL	≥3.50	≤7000 kg	54	.93(.04)[b]	.59(.04)[a]	2.70(.04)[a]
LH	≤3.25	>7000 kg	127	.79(.03)[c]	.58(.03)[a]	2.21(.03)[b]
LL	≤3.25	≤7000 kg	99	.65(.03)[d]	.57(.03)[a]	2.41(.03)[c]

[1] adjusted for HERD
[a,b,c,d] Means in the same column with no common superscripts differ (*P* < .05)

BCS ≥ 3.5. After 35 DIM, cows that produced > 7000 kg 4% FCM appeared to lose condition at a slightly greater rate until the MINBCS was reached as compared to cows that produced ≤ 7000 kg 4% FCM.

Production

The mean FCM305 by BCS1CODE were 7121 kg (BCS1 ≥ 4.0), 6994 kg (BCS1 3.50 to 3.75), 7393 kg (BCS1 3.00 to 3.25), 7250 kg (BCS1 < 3.00). The mean PEAK by BCS1CODE were 33.7 kg (BCS1 ≥ 4.0), 32.4 kg (BCS1 3.50 to 3.75), 32.8 kg (BCS1 3.00 to 3.25), 32.9 kg (BCS1 < 3.00). After adjusting for HERD and LACT, there were no significant differences in FCM305 (P > .0894) or PEAK (P > .7764) based upon BCS1CODE.

Reproduction

Cows in this study averaged 42 and 80 days to first heat and first breeding respectively. Cows were bred 1.87 times and required an average of 110 days to conceive. While there was a tendency for cows that lost more condition to appear to have poorer reproductive performance, there were no significant differences in number of breedings, days to conception, days to first heat, or days to first breeding for cows grouped by body condition score at calving or cows grouped by amount of condition loss (Table 5 and 6). Reproductive data for 66 high-producing cows (305-day FCM > 8500 kg) were separately analyzed to determine if higher-producing cows were more sensitive to BCS. There were no significant differences in reproductive performance for high-producing cows grouped by BCS at calving or amount of condition loss.

Disease

The rate of disease diagnosis in this study was 14.5% (cystic follicles), 16.6% (reproductive disorder), 15.6% (metabolic disease), 8.9% (lame), and 16.8% (other disease). BCS at calving was not significantly different

Table 5. Reproductive statistics for Holstein dairy cows in 13 PEI herds grouped by body condition score at calving.

BCS at Calving N	Times Bred[1] 386	Days to First Heat[1] 131	Days to First Breeding[1] 401	Days to Conception[2] 313
≥ 4.00	1.54(.25)[a]	53(6.14)[a]	83(4.86)[a,b]	103(12.5)[a]
3.50 - 3.75	1.75(.12)[a]	53(3.07)[a]	77(2.52)[b]	105(6.0)[a]
3.00 - 3.25	1.98(.09)[a]	49(2.57)[a]	79(1.90)[a,b]	117(4.6)[a]
< 3.00	1.95(.15)[a]	49(3.70)[a]	85(3.00)[a]	117(7.0)[a]

[1] adjusted for HERD
[2] adjusted for HERD and FCM305
[a.b] Means in the same column with no common superscripts differ (*P* < .05)

Table 6. Reproductive statistics for Holstein dairy cows in 13 PEI herds grouped by amount of condition loss.

Loss N	Times Bred[1] 387	Days to First Heat[1] 132	Days to First Breeding[1] 402	Days to Conception[1] 345
< 0.75	1.80(.11)[a]	51(3.0)[a]	80(2.4)[a]	106(5.4)[a]
= 0.75	1.98(.11)[a]	53(3.0)[a]	80(2.3)[a]	114(5.1)[a]
= 1.00	1.77(.12)[a]	48(3.3)[a]	82(2.5)[a]	108(5.7)[a]
> 1.00	2.01(.17)[a]	52(4.2)[a]	79(3.4)[a]	120(8.2)[a]

[1] adjusted for HERD
[a] Means in the same column with no common superscripts differ (*P* < .05)

Table 7. Body condition score at calving for Holstein dairy cows in 13 PEI diary herds grouped by diagnosis of selected diseases.

Disease		N	BCS1	SE	p
CYST[1]					
	Yes	62	3.21	.06	.42
	No	366	3.25	.02	
REPRO[2]					
	Yes	54	3.16	.05	.06
	No	278	3.27	.02	
MET[2]					
	Yes	51	3.20	.05	.34
	No	281	3.25	.02	
LAME[1]					
	Yes	38	3.26	.07	.83
	No	390	3.25	.02	
OTHER[1]					
	Yes	72	3.30	.05	.28
	No	356	3.24	.02	

[1] adjusted for HERD
[2] adjusted for HERD and FCM305

Table 8. Amount of Body Condition Score Loss for Holstein dairy cows in 13 PEI dairy herds grouped by dianosis of selected diseases.

Disease		N	LOSS	SE	p
CYST[1]					
	Yes	43	0.86	.05	.61
	No	290	0.83	.02	
REPRO[2]					
	Yes	54	0.85	.05	.65
	No	279	0.83	.02	
MET[2]					
	Yes	51	0.87	.05	.37
	No	282	0.82	.02	
LAME[2]					
	Yes	29	0.88	.06	.42
	No	304	0.83	.02	
OTHER[1]					
	Yes	51	0.94	.05	.01
	No	282	0.81	.02	

[1] adjusted for HERD, LACT, and FCM305
[2] adjusted for HERD and FCM305

for cows that experienced any of the diagnosed diseases (Table 7). Cows that were diagnosed with the category "other," lost significantly more condition than cows that did not receive this diagnosis (Table 8). Of 80 cows that received the diagnosis of "other" 47 (58%) experienced dystocias. There was a tendency for cows that were diagnosed with metabolic disease to have lower BCS throughout the lactation.

Efficacy of a Broad Spectrum Antibiotic Versus Clinical and Subclinical Bovine Mastitis

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Abstract

Efficacy of a broad-spectrum antibiotic effective against gram-positive and gram-negative bacteria was investigated as an experimental drug for treatment of mastitis caused by *S aureus, Staph* spp., *Strep* spp., and *E. coli.* Ten commercial dairy farms with a total of 861 cows (73 Jerseys, 788 Holsteins) with various herd sizes and types of cow housing participated. 305 day mean actual milk production ranged from 11,000 to 23,600 pounds (4994 to 10,714 kg), and mean bulk tank SCC for 6 months ranged from 130,000/ml to 815,000 on the farms. Treatments used were experimental treatment, 750 mg, or control treatment, 200 mg of cloxacillin, administered by intramammary infusion in a double blind study. Criteria for cure involved repeated reculturing of milk over 28 days combined with somatic cell count data.

Clinical mastitis was detected in 119 quarters, 34 of which were removed from the study because additional treatment was required, or the cows were sold or died. 85 clinical mastisis cases remained which met the required case definition and protocol: 8 Strep ag, 23 *S aureus*, 25 *Strep* sp., 4 *Staph* sp., 11*E coli*, 5 *Klebsiella*, and 9 Others. There were 71 cases of subclinical mastitis, 31 caused by *S aureus*, 10 caused by *Strep* sp., 29 caused by *Staph* sp., and one caused by *Klebsiella*.

Significant differences between the experimantal drug and cloxacillin in efficacy and overall cure rates for mastitis will be discussed in this presentation.

Introduction

Bovine mastitis continues to be the most costly disease in the dairy industry.[1,2] Reduction of mastitis caused by *Streptococcus agalactiae* and *Staphylococcus aureus* has not been uniformly accompanied by reduction in clinical or subclinical mastitis caused by other pathogens such as coagulase-negative staphylococci (*Staph* sp.), non-agalactiae streptococci (*Strep* sp.), and *Escherichia coli.*[3,4] Antibiotic therapy for mastitis often results in poor cure rates, especially when compared to natural elimination rates without antibiotic therapy.[5,6] Increasing sensitivity and frequency of antibiotic testing in bulk milk and slaughter cow carcasses has necessitated longer withdrawal times for milk and meat following antibiotic treatment of mastitis.[7] With the risks and costs associated with antibiotic therapy, efficacy of such treatments should be critically evaluated. This study investigated the efficacy of an experimental broad-spectrum antibiotic effective against gram-positive and gram-negative bacteria, as a treatment for mastitis caused by *Strep agalactiae, Staph aureus, Strep* sp., *Staph* sp., *E coli, Klebsiella*, and Others.