A Body Condition Scoring Chart for Holstein Dairy Cows

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ABSTRACT

A chart for body condition scoring of freely moving Holstein dairy cows was developed using an iterative process consisting of literature review, interviews with experts, field testing, statistical analysis, and comments from chart users. The chart consists of text and diagrams that detail changes in conformation with body condition change for eight body locations identified as important in body condition scoring. The precision with which a prototype chart was used to give location specific condition scores to cows was examined, and the variability among the assessors described. This chart gave consistent results with small variability among assessors, no significant difference attributable to experience of assessors, and no significant cow assessor interaction.

Minor modifications were made to the chart, which was then used to assess location specific and overall body condition scores. Assessors scored cows in the eight body locations and rescored the cows in a different order to assign an overall score. The chart produced consistent scores over a wide range of body conditions with small variance among assessors. The overall score was most closely related to the condition scores of the pelvic and tailhead areas of the cow. Both location specific scores within cows and the overall body score for a cow were strongly correlated, demonstrating that the chart was internally consistent. The chart is an effective field tool for body condition scoring Holstein cows.

INTRODUCTION

Body condition scoring (BCS) is a subjective method of assessing the amount of metabolizable energy stored in fat and muscle (body reserves) on a live animal. Jefferies (12) initially developed a BCS system for ewes. The system involved palpating the backbone and lumbar processes, feeling for the sharpness and covering of the bones. Ewes were scored on a scale from 0 to 5, where 0 was on the point of death and 5 was very fat. His technique was adapted for scoring beef cattle by Lowman et al. (16) using a 0 to 5 scale, with intermediate values for animals whose condition falls between these numbers, functioning as an 11-point scale. This system also used palpation of the backbone and lumbar processes and included palpation of the tailhead region. Subsequently Mulvany (19) modified the system for use in dairy cattle but introduced adjustment factors if the scores in the tailhead and loin areas differed. In Australia, an 8-grade system for scoring dairy cows was developed by Earle (6) and a similar 10-point system developed in New Zealand (10). Both the New Zealand and Australian scoring systems used photographs of individual cattle to define condition scores and have accompanied the photographs with a limited text description of the areas to be scored.

Body condition scoring of dairy cows in the US is generally performed according to a 1 to 5 scale (26). This method, like those used in the United Kingdom, involves palpating

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cows to assess the amount of tissue under the skin. These systems therefore require animals to be under restraint while scoring is performed. In many production systems, especially those with large herd sizes, the opportunity for this type of evaluation is limited. The Australian and New Zealand body scoring techniques, however, use only visual inspection, a preferred method when large numbers of freely moving cattle are involved. Body condition scoring performed in this way is a rapid and easy method of assessing the condition of cattle without the use of scales and is relatively unaffected by body size (10). To the authors' knowledge neither the New Zealand, Australian, nor American systems have been fully validated. Cattle condition scores have been related to milk yield and reproductive performance (2, 4, 5, 9, 10, 11, 17, 22, 23). Advice has been given regarding condition for stage of production, management decisions (16, 19, 21, 24), and in the evaluation of dairy production and nutrition (15).

Body condition scoring dairy cows is currently performed using a variety of scales and systems, and difficulty exists in interpreting the literature because of variability in the way authors apply scoring methods. The objectives of this study were to develop a condition scoring chart for freely moving Holstein dairy cows and to evaluate the precision that this chart gave when used by different assessors under practical field conditions.

MATERIALS AND METHODS

Chart

A chart for condition scoring Holstein cows was prepared after reviewing and applying the procedures currently used for condition scoring in the United Kingdom, Australia, New Zealand, and US (6, 10, 12, 13, 16, 19, 25, 26). The original template was subsequently modified by interviewing three people experienced in both Australian and US dairy cattle condition scoring methods and repeating this process until agreement on all the areas of the chart was achieved. Diagrams were added to the text to convey the gradation of body changes and reduce the dependance on written descriptions.

The chart was prepared so that each area of the cow that was considered important in assigning an overall body condition score could be examined individually for changes along a 1 to 5 scale, using .25-unit increments, functioning as a 17-point scale. A score of 1 indicated an emaciated condition, and a score of 5 indicated an obese condition. Initially, during trial 1, the chart examined nine body areas with location B8 being divided into B8 (spinous and transverse processes of the coccygeal vertebrae) and B9 (ischiorectal fossa). This was subsequently modified to the eight body locations outlined below and shown in Figure 1. The modifications were a result of user comments and the variance found for the tailhead region in trial 1. The eight areas of the cow's body were examined and criteria within each area were used to indicate the body condition. The eight locations (B1 to B8) examined were in three major regions:

1) Loin – B1 spinous processes, (the vertical prominances of the lumbar vertebrae); B2 depression between the spinous and transverse processes; B3 transverse processes (the transverse prominances of the lumbar vertebrae); B4 overhanging shelf formed by the transverse processes above the flank.

2) Pelvis – B5 tuber coxae (hooks) and tuber ischii (pin bones) bony prominances; B6 depression between the hook and pin bones; B7 depression between the hooks.

3) Tail head – B8 spinous and transverse processes of the coccygeal vertebrae and ischiorectal fossa (depression beneath the tail).

Precision: Trial 1

The chart precision was evaluated by nine assessors, each scoring the same 59 cows, and rescoring 16 of these animals as a convenience sample.

Assessors. The nine assessors were considered in three groups: 1) three experts involved in the development of the scale; 2) three novices with some experience in condition scoring cattle; and 3) three beginners who had never condition scored cattle or seen the chart prior to this trial, but who were familiar with cattle.

Cattle. Seventy-two cattle were selected from one dairy, which had 2000 lactating Holstein cows available. Animals were chosen by a stratified random procedure, the strata being parity (first, second, or subsequent

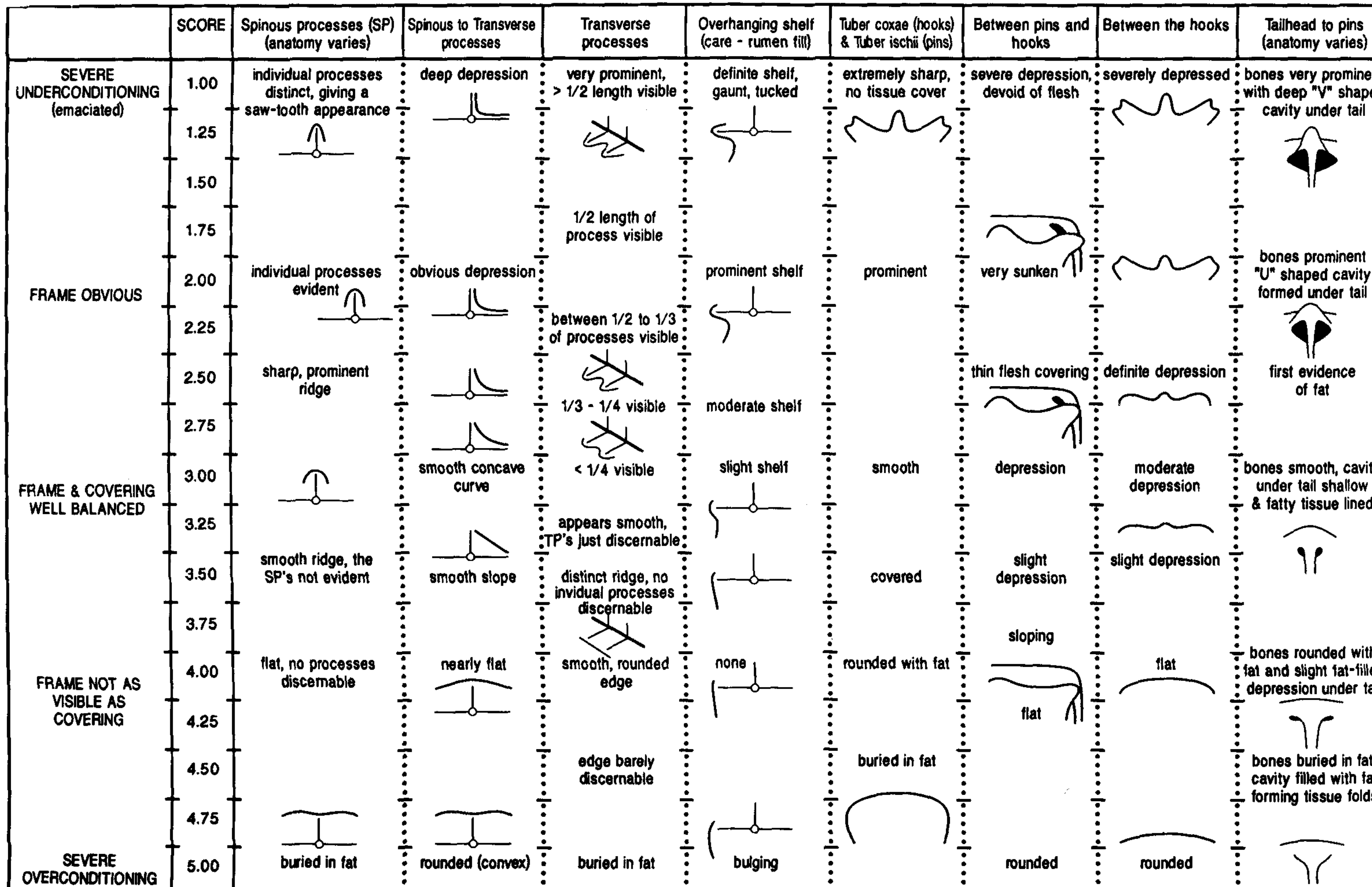

Figure 1. Body condition scoring chart for Holstein cows.

lactation), and within each parity, days in milk (DIM) (0 to 120, 121 to 240, 241 to dry, and dry). The final selections were made using a table of random numbers and the last two digits on the cow's ear tag. The 16 animals for rescoring were a random convenience sample from several pens.

Design. The nine assessors were given the scoring chart 1 d prior to the trial, and the chart design was discussed before arriving at the dairy. Photographs of dairy cattle were used to discuss the areas included on the scoring chart and the ranges of condition in each area.

Selected cows moved freely with other cattle in dry lot or freestall housing during scoring. The assessors moved from cow to cow as a group, viewing each animal and assigning a score to each body location. The condition score assigned to a body location was not discussed between assessors. After all available cattle had been scored, 16 cows were rescored using the same procedure, without reference to the previously assigned scores.

Precision: Trial 2

The usefulness of the chart was examined by six assessors; five of whom had used the chart in trial 1, and one who had not scored cows with the chart previously but was experienced with dairy cattle. Each assessor scored the same 25 cows. The 25 cows were a convenience sample selected from the corrals of a dairy with 2000 Holstein cows available. The cows were selected to represent a wide range of body conditions.

Each assessor scored the 25 cows in the eight body locations by marking the chart where the criteria on the chart matched the appearance of the cow. The 25 cows were then rescored in a different order to minimize the correlation between the two assessments. When rescored, the cow was given an overall body condition score without reference to the location specific scores previously assigned. Cows moved freely with other cattle in dry lot or freestall housing during scoring. Consultation among assessors did not occur.

Analysis

Trial 1. Preliminary data description was performed using a statistical graphics program (Statgraphics, 1985 STSC, Inc., Rockville MD). The body condition scale was considered continuous (even though the scores were corrected to the nearest .25 point) and normality assumptions made. This allowed the scores from each body location to be examined by ANOVA using statistical software (SAS Institute, Inc., Cary, NC). Initially, the effects of assessor, cow, expert category, parity, and DIM were examined using a partially hierarchal (nested) analysis of covariance. A final evaluation, using only the variables found to be statistically significant in the preliminary analysis, was made using a random effects ANOVA model.

The final model is given below:

$$Y_{jln} = u + a_j + c_l + (ac)_{jl} + e_{jln}$$

where u is a constant, a_j (assessor), c_l (cow), and $(ac)_{jl}$ (interaction) are independent normal random variables with expectations zero and respective variances σ_a^2, σ_c^2, and σ_{ac}^2; e_{jln} are independent $N(o, \sigma^2)$, and independent of a_j, c_l, and $(ac)_{jl}$ $j = 1,\ldots 9$; $l = 1,\ldots 59$, $n = 2$ for 16 cows that were rescored, otherwise $n = 1$.

Trial 2. Using statistical software (BMDP Statistical Software, 1985, Los Angeles, CA), the data were examined by cluster analysis to determine which body locations were scored similarly, and the correlations among each body location with the overall body condition score assigned. By considering the body condition scale as continuous (even though the scores were corrected to the nearest .25 point) and making normality assumptions, the data were further examined by ANOVA. A random effects model was used to estimate the magnitude of the factors determining the condition score. In this trial, there was no estimate of the error of the variance, because no replication in the scoring of each body location occurred. To determine if the interaction term among assessor and cow could be used as a proxy for the error term, the interaction term was compared with both the estimate of the error term and the interaction term obtained in the previous trial.

RESULTS

Trial 1

Of the 72 cows selected in the sample, 59 were available for scoring. Box plots suggested that higher parity cows may have significantly higher body condition scores than lower parity cows, but the number of cows scored in the fifth, sixth and seventh parity groups was very small (Figure 2). Box plots display batches of data, the middle line shows the median, the top and bottom lines of each box show the upper and lower quartiles, the vertical lines show the extremes, and the plus symbols indicate outliers. Notches indicate the 95% confidence intervals of the medians; overlap of the notches suggests no significant difference between the data sets (18). Analysis of variance indicated no significant source of variability attributable to parity above the degree of variability among cows within the parity groups. Days in milk was not a significant covariate. No significant source of variability could be attributed to expertise category above the degree of variability among assessors within these categories (Figures 3 and 4). These results were consistent for the data from all nine body locations. The analytical design, therefore, reduced to one involving the factors "cow" and "assessor", both being considered random. The two-way analysis of variance showed no significant interaction between "assessor" and "cow" in all nine body locations where scoring took place in the replicated trial.

"Assessor" and "cow" main effects were significant ($P<.0001$) in all nine body locations (Tables 1 and 2). Residual variation in the data

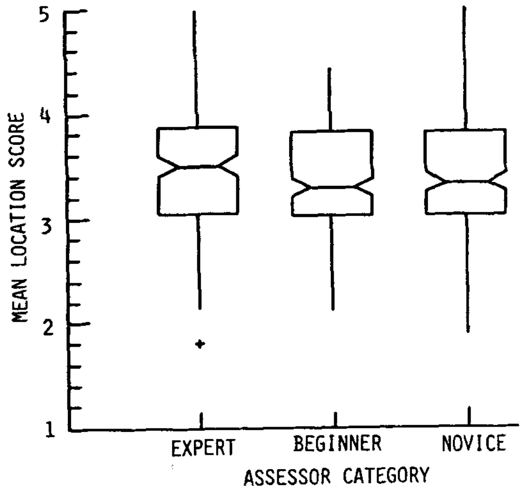

Figure 3. Notched box and whisker plots illustrating the distribution of the condition scores (mean from the 9 body locations) given by the different categories of assessors.

not explained by the variation among assessors or among cows is given as error (Table 3). For all locations, variability among cows had a much greater impact on the variance of the location specific mean scores than the variability among assessors (Table 4). In locations B8 and B9, the variability among assessors was larger than in other body areas. Thus, the

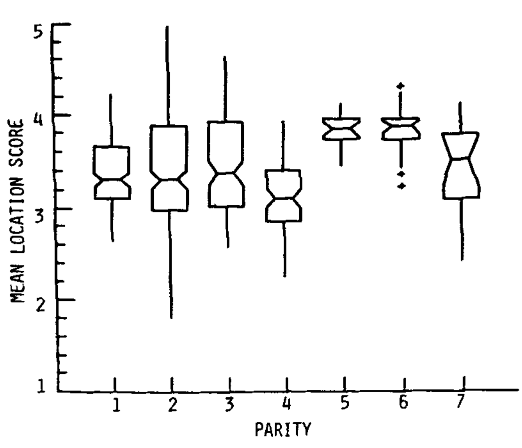

Figure 2. Notched box and whisker plots illustrating the effect of parity on the distribution of the condition scores (mean score from the 9 body locations).

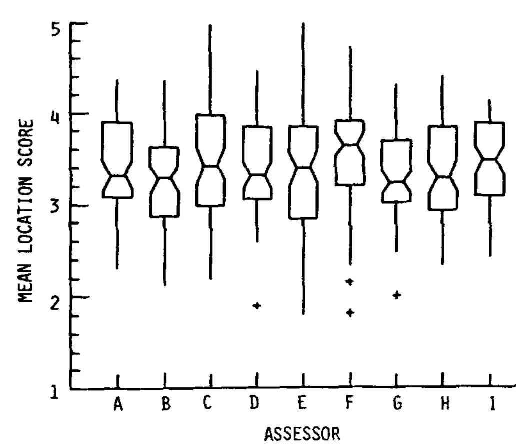

Figure 4. Notched box and whisker plots illustrating the distribution of the condition scores (mean for the 9 body locations) given by each of the 9 assessors.

TABLE 1. Point and interval estimates of variance of the assessor and F-statistics for testing H_0 : variance of the assessor = 0 (Trial 1).

Body location	F-Statistic[1]	Assessor variance	95% Confidence in terval
B1	8.9	.00682	.00288, .03126
B2	6.1	.00555	.00224, .02948
B3	4.7	.00445	.00157, .03874
B4	12.1	.01311	.00566, .05623
B5	4.9	.00325	.00127, .01914
B6	9.9	.00878	.00374, .03922
B7	9.0	.00789	.00333, .03611
B8	29.2	.03353	.01497, .17534
B9	19.2	.03060	.01349, .12345

[1] All significant ($P<.0001$).

TABLE 2. Point and interval estimates of variance of the cow and F-statistics for testing H_0 : variance of the cow = 0 (Trial 1).

Body location	F-Statistic[1]	Cow variance	95% Confidence interval
B1	33.5	.18383	.13051, .27826
B2	31.3	.22628	.16053, .34286
B3	30.6	.23487	.16659, .35601
B4	29.1	.21685	.15372, .32896
B5	41.1	.21842	.15534, .32977
B6	30.6	.19239	.13646, .29160
B7	32.0	.20133	.14287, .30496
B8	36.0	.27293	.19389, .41273
B9	30.2	.32295	.22903, .48691

[1] All significant ($P<.0001$).

TABLE 3. Point and interval estimates of the error (Trial 1).

Body location	Error	95% Confidence interval
B1	.06458	.05789, .07250
B2	.08534	.07638, .09565
B3	.09074	.08121, .10170
B4	.08821	.07895, .09887
B5	.06226	.05572, .06978
B6	.07408	.06630, .08303
B7	.07423	.06643, .08320
B8	.08912	.07976, .09989
B9	.12640	.11313, .14167

TABLE 4. Point and interval estimates of the mean and the estimate of its variance (Trial 1).

Body location	Estimated mean	95% Confidence interval	Summary of the sources of variability in the body condition scores				
			Estimated total	% Assessor variability	% Cow variability	% Other sources of error	Coefficient of variance (%)
B1	3.47585	3.35, 3.60	.00397	19.1	78.6	2.5	.29
B2	3.52185	3.39, 3.65	.00458	13.5	83.8	2.7	.32
B3	3.44286	3.31, 3.58	.00461	10.6	86.3	3.1	.33
B4	3.33800	3.20, 3.48	.00526	27.8	70.0	2.2	.34
B5	3.49230	3.37, 3.62	.00416	8.7	88.9	2.4	.27
B6	3.42326	3.29, 3.55	.00435	22.5	74.9	2.6	.31
B7	3.35548	3.23, 3.49	.00446	19.7	76.5	3.8	.31
B8	3.21252	3.03, 3.39	.00848	44.0	54.6	1.4	.35
B9	3.32941	3.14, 3.52	.00906	37.5	60.4	2.5	.41

largest estimates and confidence intervals of the variance of the estimated mean were obtained from these areas. The estimate of the mean from all nine body locations was similar; however, certain locations tended to give high scores (B2 and B5) and others gave low scores (B8, B9 and B4) (Table 4).

Trial 2

The condition scoring chart is shown in Figure 1. The eight locations on the cows body are defined, and criteria within each area are described. The scale for the body condition is continuous, but for convenience, the chart is marked in .25 increments.

Cluster analysis indicated that body condition scores given for the first four body locations (B1 to B4) tended to cluster, as did scores given to the last four body locations (B5 to B8) (Figure 5a). The overall body condition score given by the assessors fell within the group of pelvic and tailhead location scores (B5 to B8) (Figure 5b). Overall body condition score was associated most closely with the scores given for the bony prominences of the hook and pin bones (B5) (Figure 5b). Correlation coefficients were greater than .92 among all the body locations, including the overall score.

The ratios of the interaction term compared to the estimate of the error or the interaction obtained from the first trial were all close to 1. The interaction term could, therefore, be used as a proxy for the error term in the analysis of variance. The analysis of variance showed the among cow main effects to be significant ($P<.0001$) in all eight body locations (Table 5). The among assessor variability was significant ($P<.0001$) in all body locations except B6 and

TABLE 5. Point and interval estimates of variance of the cow and F-statistics for testing H_0: variance of the cow = 0 (Trial 2).

Body location	F-Statistic[1]	Cow variance	95% Confidence interval
B1	27.02	.39567	.23727– .78894
B2	38.39	.46766	.28185– .92396
B3	33.00	.51277	.30844–1.01665
B4	39.09	.48446	.29204– .95679
B5	46.88	.53495	.32309–1.05287
B6	35.93	.45205	.27222– .89443
B7	42.98	.47773	.28828– .94172
B8	47.47	.58397	.35274–1.14910
Overall	63.42	.48812	.29555– .95636

[1] All significant ($P<.0001$).

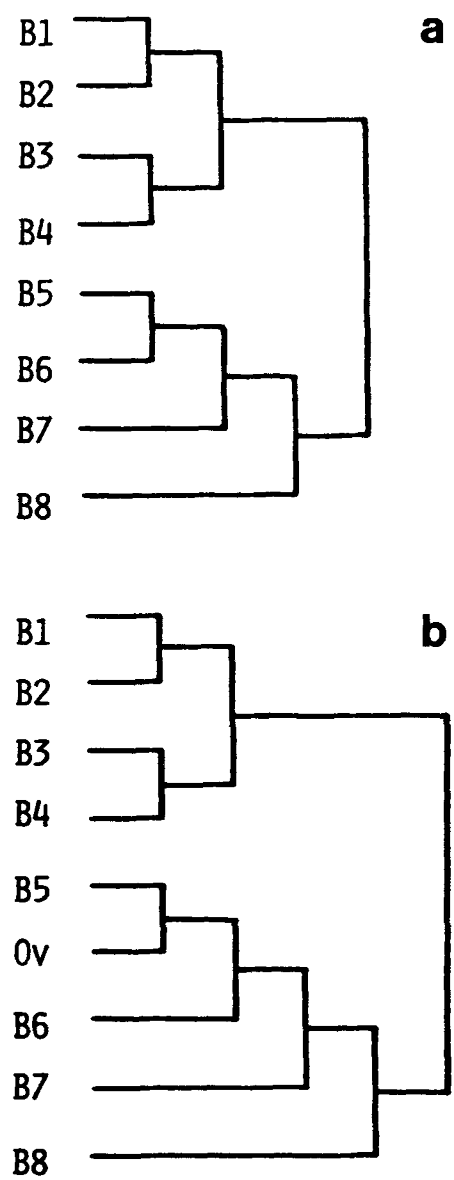

Figure 5. Tree diagrams summarizing the cluster analysis of body condition socres. The most closely related body locations are connected in successive steps from left to right (1). 1. Relationship among the condition scores given for each location by all the assessors. b. Relationship among the condition scores given for each location and the overall scores by all the assessors.

TABLE 6. Point and interval estimates of variance of the assessor and F-statistics for testing H_0 : variance of the assessor = 0 (Trial 2).

Body location	F-Statistic	Assessor variance	95% Confidence interval
B1	7.53[a]	.02385	.00837–.21381
B2	5.26[a]	.01279	.00425–.14460
B3	7.03[a]	.02318	.00807–.21461
B4	4.94[a]	.01203	.00395–.14523
B5	8.46[a]	.02088	.00742–.17896
B6	2.08	.00336	.00077–.00833
B7	.93	.00019	. . .[1]
B8	8.19[a]	.01268	.00768–.18802
Overall	11.57[a]	.01983	.00724–.15222

[a] $P<.0001$.

[1] Too small to calculate.

TABLE 7. Point and interval estimates of the errors.

Body location	Error	95% Confidence interval
B1	.09124	.07193–.11956
B2	.07505	.05917–.09835
B3	.09614	.07579–.12598
B4	.07631	.06016–.10000
B5	.06995	.05515–.09166
B6	.07764	.06121–.10174
B7	.06828	.05383–.08948
B8	.07540	.05944–.09881
Overall	.04692	.03699–.05868

B7, where no significant variability was found among the assessors (Table 6). The residual variation not explained by assessor or cow is given in Table 7. For all eight locations, variability among cows had a much greater impact on the variance of the location specific mean scores than the variability among assessors (Table 8).

In assigning the overall body condition score, the assessor and cow variances were also significant. However, the variance of the overall score fell within the confidence intervals of the location specific variances (Tables 5 and 6).

DISCUSSION

Body condition scoring systems have been difficult to interpret due to inadequate detail. Some have been based on photos with minimal interpretation and others on lengthy written descriptions. This may limit the repeatability of the system to assessors working closely together. Scoring systems reflect body nutrient reserves of cattle (10, 14, 27). Wright and Russel (27) examined 73 dairy and beef cows and showed that the condition score was related to the proportion of fat in the live weight and to body water, protein, ash, and body energy. They also found that breeds differ in the partitioning of fat among the various deposits, which resulted in these breeds differing in the proportion of total body fat at the same body condition score. In all but the thinnest cows, intermuscular and intramuscular fat constituted the major deposit.

TABLE 8. Point and interval estimates of the mean and the estimate of its variance (Trial 2).

			Summary of the sources of variability in the body condition scores			
Body location	Estimated mean	95% Confidence interval	Estimated total	% Assessor variability	% Cow variability	% Other sources of error
B1	3.40833	3.28–3.53	.0204	19.5	77.6	2.9
B2	3.33667	3.05–3.62	.0213	10.0	87.8	2.2
B3	3.23433	2.92–3.54	.0250	15.4	82.0	2.6
B4	3.21000	2.92–3.50	.0219	9.1	88.4	2.3
B5	3.23000	2.92–3.54	.0253	13.7	84.5	1.7
B6	3.26667	2.99–3.54	.0192	2.9	94.3	2.7
B7	3.22167	2.95–3.50	.0196	.15	97.5	2.3
B8	3.21833	2.89–3.54	.0275	13.2	85.0	1.8
Overall	3.29500	3.00–3.59	.0232	14.3	84.2	1.3

Several workers (3, 9, 16) found scores correlated with subcutaneous fat depth measured by ultrasound, and relationships with body weight and heart girth measurements have been found (3). Johnson (13) showed that the change in condition score followed the pattern of live weight change in dairy cattle, and others (8, 10) have estimated the live weight change associated with changing condition score. Surface profiles of cows around the loins and rump have been correlated with the condition score (10). Wildman (26) similarly found body weight and frame measurements correlated with body condition score. Condition scores have also been related to biological measures (25), milk yield (10, 11, 23), and reproductive performance (2, 4, 5, 10, 22).

The chart developed in this study resulted from an iterative process of literature review, interviews with experts, field testing, statistical analysis, and comments from chart users. Scoring with a chart removes the influence of the individual cow by using diagrams, rather than photographs of single cows, to depict change in conformation with weight gain or loss. Further, this format minimizes the difficulty of interpreting written description and focuses the assessors attention on each body location before assigning an overall score.

The analyses of variance indicate the relative magnitude of the components that affect the assigned condition score. The variance also indicates the precision with which a score may be assessed by several observers (7). Our analyses found that significant variation generally exists between assessors when each body location was scored. Trial 1 found no significant difference between assessor expertise category, suggesting that the chart enabled beginners to condition score cattle with a similar precision to experienced assessors. The variability of the score given by an assessor on the first and second observation in trial 1 was very small. Other sources of variability in addition to assessor (i.e., expert category) and cow (i.e., replication, days in milk, and parity) represented a very small portion of the total variability (coefficient of variance .27 to .41%).

Trial 1 demonstrated that scores given by the assessors were almost parallel across the cows scored (no significant cow-assessor interaction). This indicates that all assessors increased and decreased the score assigned from cow to cow by a similar amount, even if they did not assign the same score (similar accuracy on all cows). Thus there was consensus among assessors on when a body condition score was high and when it was low. The lack of interaction indicates that the chart enabled assessors to score cows without bias in their interpretation of the subjective criteria on different animals. Both Evans and Nicoll (7, 20) found this interaction term to be significant and in some cases to be larger than the variance between assessors.

The overall mean scores obtained in trial 1 reflect the average condition score of cows on the dairy, since the stratified sample of cows scored was representative of all the cows on the dairy. The between cow variability is consistently larger than the variability between assessors, indicating that the scoring procedure works.

Trial 2 was designed to evaluate a wider range of body conditions than assessed previously. The cow variances calculated were consequently greater than those in the original trial and cows were more varied in condition than previous studies cited (7, 20). This may have been due to cow selection procedures used in each study. Nicoll (20) used cattle going on to, and finishing, a feeding trial. Consequently, it is probable that these cattle were in similar body condition. Evan's (7) cattle were scored in smaller groups (range 9 to 24, mean 14) than the number of cows in this study, and the smaller numbers may have resulted in less variability.

Significant assessor variation was found (variance .01 to .02) except in two body locations. The depression between the hook and pin bones and the depression between the hooks (B6 and B7) had no significant variance among assessors. Despite the greater range of conditions scored, assessor variability was similar to or less than in trial 1, indicating that the precision with which body condition is assessed has improved. Compared with results of Evans (7) and Nicoll (20), the assessor variability was similar or slightly less, despite a more varied range of cattle. This suggests that either the new chart was easier to interpret because of the improvements, or assessors have learned to score cows more consistently with the chart, or both these factors were involved.

Cluster analysis is used to group individuals with similar attributes (1). Location specific scores from trial 2 fell into two main clusters; those related to the loin and spinous region (B1 to B4), and those from the pelvic and tailhead regions (B5 to B8). Thus change in condition is related most closely within similar anatomical regions of the cow, suggesting that the scale developed is effective. Additionally, the scores from all body locations are highly correlated. Both these findings indicate that the chart is internally consistent, since scoring criteria are correctly located on the scale for different body locations of the cow.

The overall body condition scores assigned in trial 2 fell within the pelvic-tailhead cluster of scores. This may have been influenced by a tendency to score cows from behind. The overall score most closely reflects the scores given to the bony prominence of the hook and the pin bones (B5), the depression between the hook and pin bones (B6), and the depression between the hooks (B7) (Figure 5b). The assessor variance on these three body locations is small (.0209 to .0002), being nonsignificant in B6 and B7. This suggests that these body locations are reliable areas to use when scoring freely moving cows. The assessor variance found on the overall score is within the confidence intervals of the variance for the individual locations, indicating that a single score may be given to cows with confidence.

Previous authors who scored with palpation techniques have given greater emphasis to the tail head and loin regions. Our findings suggest that, in the range of conditions scored (overall scores 1.5 to 5.0, mean 3.3), the depression between the hooks and the depression between the hook and pin bones may be most important, since no assessor variance was found in these areas. The emphasis previously placed on the loin and tailhead may have resulted from the palpation techniques used in other systems (16, 21, 26, 27), since palpation of the tailhead may be easily performed in tie stall facilities. Further, differences may exist in the relative merit of anatomical locations in reflecting tissue deposits at different body conditions. Differences in genotype among this study population and other populations previously studied may have resulted in a different emphasis since genotype influences the distribution and mobilization of body tissue (22).

In recommending appropriate body condition scores at particular stages of the production cycle, consideration must be given to the genotypic differences in fatness at any condition score (27). The study population consisted of a sample of Holstein cows from one dairy, and the target population for this chart is all Holstein dairy cows. The application of this chart to other breeds may be biased due to genetic differences in their distribution of fat.

This BCS chart provided standard procedures of known precision to condition score freely moving Holstein dairy cows. This chart can be used repeatedly, as described, to provide a condition scoring training tool, ensuring that each area of a cow is observed and evaluated before a condition score is assigned. Once the assessors are confident with the procedure involved in assigning a score, only periodic reference to the chart should be required to maintain consistency in assessing the overall condition score between observers. This study has shown that the effects of parity, DIM, and expert category do not significantly affect the analysis of scores assigned by an observer using this chart.

Our chart indicates the score from a single area is a good indicator of the overall score of the cow. If the assessor cannot view all body areas, a condition score can still reliably be given to the cow, because of the small variance in mean body location scores found in trial 1 and the close relationship of the overall score to the body location scores found in trail 2. It was demonstrated in trial 2 that an overall body condition score can be assigned with little variance between assessors who used this chart.

Trials have demonstrated that while body condition scoring is a subjective technique, it can be related to objective measures of biological change (2, 4, 5, 9, 10, 11, 22, 23, 26). In this paper, use of a body condition chart as a field tool is demonstrated. The chart proved to be a method of ensuring precise responses from a group of assessors scoring freely moving Holstein cows. An overall score may be given with confidence to cows by using the chart. The process of chart development described in this study produced a practical tool to reduce subjectivity in body condition scoring. The authors caution that, as with other body condition score systems, biological relationships found with body condition scores evaluated by this method should not necessarily be extrapolated to scores performed by another method.

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