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BODY CONDITION SCORING

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Live weight change is a poor estimate of tissue mobilization in lactating dairy cows because it is confounded due to increases in dry matter intake and gut fill and changes in tissue composition that occur in the postpartum period. Therefore body condition scoring has received considerable attention as a means to estimate tissue mobilization and fat reserves in lactating dairy cows (3,6). There are differect scoring systems, such as 0 to 5 in England and 0 to 9 in beef animals, but the most common system in use in the US in dairy cows uses a scale of 1 to 5 with 1 being emaciated, 2 thin, 3 average, 4 fat, and 5 obese (6). It is common to divide the scale into 0.25 point increments. Researchers in Californina have developed a chart to facilitate scoring cows (1). Body condition scoring has not been widely adopted for use as a tool for management decisions. Reasons for this probably are associated with the lack of data quantifying body condition change in lactating cows. This paper will present a summary of data we have collected to assess body score change.

Quantifying Body Condition

Previously we have described that body condition change correlates well with cumulative negative energy balance (2), lipid content of the carcass (3), and should be no more than one condition score loss by 30 days in milk for an individual cow (2). On a herd basis cows should only lose about 0.5 body condition units from calving to 30 days in milk. This is within ranges observed by Ruegg et al. for 66 cows in a California dairy (5). If cows are too fat at calving (>3.5) and if diets are not provided ad libitum or are not well formulated, cows may lose more body condition (2,3,5). We have observed that less than 15% of cows in a herd will lose one condition score or more if diets are provided ad libitum to lactation cows (Ferguson, unpublished observation).

A summary is presented in the table below.

One Body Condition Loss	Item
Tissue Mobilized	54 kgs (40-77 kgs)
Cumulative Negative Energy	-400 Mcal (-300 to -500)
Average Condition Loss - Group	-.5 units
Time to Maximum Loss	30 days post calving
Time to Increase in Condition	50-70 days post calving
Optimum Condition at Calving	3.0 to 3.5

The pattern of condition change is very typical for what we have observed in many herds with good to excellent feeding programs. On average cows lose about 0.5 unit of body condition by 30 days in milk. Typically cows begin to increase in body condition by 50 to 90 days in milk. This extent of condition loss is well tolerated by lactating cows, and fertility is not impaired by condition loss within these limits. However, we have observed herds with more extensive change in body condition, extending over longer time periods. This represents extreme management problems in feed management and may be associated with reduced CR. Associations with body condition difference between calving and first insemination body condition score are as follows (N=516 cows):

Body Condition Change	CR	(95% confidence limit)
+ 1.0	61.7	(53.9,68.9)
+ .5	55.9	(47.9,63.6)
0	50.0	(42.1,57.9)
- .5	44.1	(36.4,52.1)
- 1.0	38.3	(31.1,46.1)

Condition loss is not higher for higher producing cows, unless the feeding program is substandard. We have been collecting data on body condition score and production and reproduction from several farms. Data have been examined for 1300 cows from one herd to look at the interaction between body condition at calving and milk production. Cows follow the typical pattern for condition change outlined in the above table. There are no significant effects of body condition score at calving on milk production, nor is there significant interaction between body condition score at calving and genetic merit. There is no advantage to have cows above a 3.5 in condition at calving. Genetic ability has not influenced condition loss or optimum condition at calving. Body condition is a useful monitoring tool in dairy herds to define efficiency of feeding on the farm.

Repeatability of Body Condition Scoring

Questions continuously arise concerning the repeatability of body condition score between and within observers. Edmonson et al. reported high correlations between observers (1). To examine this issue we had 4 observers, who had never scored cows together, score 249 cows in three replicates. Observer 4 only was present for the first 80 cows, therefore data for him will not be presented in entirety. Observer 3 walked down the feed alley and scored cows from the front end, while observers 1 and 2 (and 4) scored cows from the rear. Cows were held in lock ups at the feed manager for scoring. Results are as follows:

Correlation between observers scoring cows in replicates.

	Observer 1	Observer 2	Observer 3
Mean score sem	3.26 .47	3.26 .46	3.17 .45
Correlations			
Observer 1	0	0.93	0.89
Observer 2	0	0	0.89

Correlation between observers was high. Correlation between observer 4 and observer 1 and 2 was .94 and .93, repectively, and .89 with observer 3. These correlations are similar to ones we observe for individuals assessing the same cows later on the same day or on the following day.

However, correlations may be high yet there may be a systematic bias between observers. To examine this we looked at the difference in score between observers:

Distribution of differences between observers as a percent

Difference	Observer 1 - 2	Observer 1 - 3	Observer 2 - 3
-0.75	0.4	0	0
-0.5	1.2	1.7	1.7
-0.25	21.1	16.2	14.5
0	56.2	35.7	38.6
0.25	20.5	37.3	35.3
0.5	1.2	8.3	9.1
0.75	0.4	0.8	0.8

Differences between observer 1 and 2 are normally distributed around 0 and 97% of the observations fall within .25 units. Differences between observer 1 and 3 and 2 and 3 indicate a bias, as more scores are +.25 units higher for observer 1 and 2 than observer 3. Observer 3 scored cows from the front, which may have imposed a bias of lower condition scores in certain cows, since the tail head and rump were not as visible. Observer 3 was lower in score in 15% of the cows. However, 90% of observations still fall within .25 units. This data suggests that body condition is repeatable between individuals. Variation within an individual scoring the same group of cows follows a similar pattern.

Agreement between individuals may occur due to chance. A test statistic called Kappa measures the reliability of the test above chance. The Kappa for body scoring between observer 1 and 2 is .48 which indicates body condition scoring has moderate

test value. If we included the .25 "noise" as agreement, then body condition scoring would have a higher value as a diagnostic test.

To refine body condition scoring, we have examined principal components of body condition scoring. Much like the California chart (1) we asked four observers to describe body regions as they scored several hundred cows. We then used principal components analysis to examine the major differences in body region with change in body condition score. In addition we could use this analysis to see if body condition scores could be separated by .25 units.

Presented in figure 2 is the resulting chart of the analysis. Specific changes occur with each increment in body condition change. Between condition scores 2.5 to 4.0, body condition could be separated into .25 units. Below 2.5 and above 4.0 cows could only be classed on .5 increments. A major classification occurs at the rump, separating cows into a class above a 3.0 and a 3.0 or less. If the rump appears as a "V", then cows are a 3.0 or less; if it appears as a "U", cows are a 3.25 or higher. The hook and pin bones classify cows from a 2.0 to 3.0. If the rump was a "V" and the hook and pin bones padded, the cow was a 3.0. If the hook bone was angular and pin bone padded, the cow was a 2.75 and so on. Cows below a 2.5 are too thin. These cows have no fat pad over the pin bone. This is very easy to communicate to producers.

Above a score 3.0, cows are classified by the appearance of the coccygeal-ischial ligament (tail head ligament) and sacral-ileal ligament (sacral ligament). If both ligaments are apparent, and the rump is a "U", the cow is a 3.25. If the tail head ligament is dull in appearance and sacral ligament apparent, the cow is a 3.5. Cows with a dull sacral ligament are a 3.75. Cows 4.0 or higher have no visible sacral ligament. This is easy to communicate to producers what cows are too fat.

This system has proved to be very repeatable and easy to train novice scorers. It is simple to teach producers. We have tested several groups of students and veterinarians with this system and find it useful.

Using Body Condition Scoring as a Management Tool

How frequently should herds be condition scored? We have looked at weekly, biweekly, and monthly body condition scoring in herds. It would appear monthly scoring is frequent enough for most farms.

Body condition score may be tracked via groups of cows rather than individual cows. A random sample of cows within groups are scored by walk through, such as the high group, middle group, low group and dry group and distribution of scores compared. The mean score is compared between groups to assess change. In addition the percentage of cows above and below thin and fat scores are assessed. Fewer than 10% of cows should be below 2.5 and above 4.0 in specific groups. If numbers are higher than this then problems are occurring in the herd. Excess condition loss may be due to health problems, excessive body condition at calving, nutritional imbalances, feed delivery

problems, socialization difficulties and other factors. Excessive extremes in body condition are a symptom of a problem, not the problem.

Body condition score and score change should be assessed across the dry period, usually by examining cows at dry-off and at calving. A condition score at 30 days in milk should be the lowest point cows drop. Often differences in the springing pen and high production string will reflect the change in early lactation body condition score. Differences in middle and late lactation strings will indicate repletion of body tissue. Cows should be 3.5 going into the dry lot.

About 27 kg of tissue gain will result in an increase in 0.5 body condition unit. In herds feeding TMR's, cows will eat about 5 mcal/day net energy over requirement. This results in 0.226 kg of lipid accretion/day, so cows will gain about 1.8 kg of lipid/week after 13 weeks of lactation. This will allow condition score increase of about .25 units in 4 to 6 weeks. However, the standard error on this mean is about 2 mcal, thus there is considerable individual cow variation. The feed management program on the farm must control the extent of body tissue repletion. Body condition scoring provides a tool to assess the management feeding program on the farm.

References

1. Edmonson, A. J., I.J. Lean, L.D. Weaver, T. Farver, G. Webster. 1989. A body Condition Scoring Chart for Holstein Dairy Cows. J. Dairy Sci. 72:68.
2. Ferguson, JD. 1989. Managing Body Condition in Dairy Cows. Proceedings Cornell Nutrition Conference for Feed Manufacturers. Oct 24-26, 1989. Syracuse, NY. pp75.
3. Garnsworthy, P.C. 1988. The effect of energy reserves at calving on performance of dairy cows. In: Garnsworthy PC, ed. Nutrition and lactation in the dairy cow. London Butterworth, 157.
4. Otto, K.L., J.D. Ferguson, D.G. Fox, and C.J. Sniffen. 1991. Relationship Between Body Condition Score and Composition of the Ninth to Eleventh Rib Tissue in Holstein Dairy Cows. J. Dairy Sci. 74:852-859.
5. Ruegg, P.L., W.J. Goodger, C.A. Holmberg, L. D. Weaver, E. M. Huffman. 1992. Relation among body condition score, milk production, and serum urea nitrogen and cholesterol concentrations in high-producing Holstein dairy cows in early lactation. Am J. Vet. Res. 53:5.
6. Wildman, E.E., G.M. Jones, P.E. Wagner, and R.L. Bowman. 1982. A dairy cow body condition scoring system and its relationship to selected production characteristics. J. Dairy Sci. 65:495.

<u>Decision Algorithm for Body Condition Scoring</u>:

5.0		overall appearance		
	4.75		Hook bone just visible	
4.5		Flat	Hook and Pin bone appearance - pin bone not visible	
	4.25			Tips of transverse processes not visible
4		Flat U'	No visible sacral or coccygeal ligaments	- Transverse processes just visible
	3.75		Tail head ligament not visible, sacral ligament barely visible	

TOO FAT

3.5		U	Coccygeal ligament barely visible, sacral ligament visible
	3.25		Sacral/coccygeal ligaments visible
>3		U	Sacral/coccygeal ligaments appearance

START -   Rump   V or U

<=3		V	Hook and Pin bone fat pads
	2.75		Hook is angular/Pin padded
	2.5		Hook is angular/Pin is angular - palpable fat pad on pin

TOO THIN

<2.5		V	Hook and Pin bone angular - look at Tranverse processes
	2.25		Short Ribs - Transverse processe edge to spine
	2.00		2.25 .5-.6 tip to spine
			2.00 .75 tip to spine
<2.0			Thurl bone appearance
			Spine, overall appearance