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RELATIONSHIPS BETWEEN BODY CONDITION SCORES  
AND LIVE ANIMAL MEASUREMENTS OF BEEF COWS

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CATTLE 88-13

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Summary

Records from 133 mature Simmental x Angus cows collected over a 3-year period were used to determine the relationships between body condition scores and other measurements of cow body condition. Positive correlations were found between condition scores and backfat, weight/height ratios and cow weight. Correcting weight/height ratios of pregnant cows for weight of the conceptus did not improve the correlations with condition score. Backfat measurements had limited use in describing body condition, since backfat was near zero for cows less than condition score 5. Equations using condition scores accurately predicted weight/height ratios.

(Key Words: Beef Cow, Condition Score, Weight/Height Ratio, Backfat.)

Introduction

Reproductive performance of beef cows has been shown to be affected by cow body condition at calving and breeding. Condition scores are subjective evaluations of cow body condition that are highly correlated with body composition or degree of carcass fat and muscle. Weight/height ratios and backfat are objective measurements of cow body condition that can be obtained without having to sacrifice the animal.

This report is derived from a 3-year study conducted to determine the minimum cow body condition before calving and breeding necessary for adequate reproductive performance. The objective related to this paper was to determine the relationships between condition scores and other live animal measurements of cow body condition.

Materials and Methods

Simmental x Angus crossbred cows were wintered at the SDSU Range and Livestock Research Station near Philip, South Dakota, and grazed summer pastures near Sturgis, South Dakota. Calving occurred from mid-March until mid-May. Wide ranges in cow body condition were established prior to calving and in early May by assigning cows to high or low early and late winter nutritional treatments. In March, May and June of each year, condition scores (CS 1-9, 1 = severely emaciated) were assigned cows using the average score of two assessors. A more complete description<sup>3</sup> of condition scores are outlined in paper 88-11 of this publication. Backfat measurements using a Cook's probe were taken over the loin between the 12th and 13th ribs for the first 2 years of the study. Each year hip height was averaged using three monthly measurements. Weight/height ratios were computed by dividing live weight (after feed and water were removed overnight) by hip height. Cow weights in early March were adjusted for conceptus weight using the following equation:

$$\text{Adjusted weight} = \text{Actual weight} \cdot \frac{\text{Calf birth weight}}{.6} + (1.25 \times \text{No. of days to calving})$$

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### Results and Discussion

Nutritional treatments produced a wide range of cow condition scores in March, May and June (Tables 1, 2 and 3). Average hip heights were similar across a wide range of condition scores, indicating that frame size did not influence an assessor's ability to evaluate cow body condition. Cows in condition score less than 5 had little or no measurable backfat ( $\leq .02$  in).

TABLE 1. MEAN LIVE ANIMAL MEASUREMENTS TAKEN IN MARCH BY CONDITION SCORE

Live animal measurement	Condition score					
	3	4	5	6	7	8
No. of cows	10	46	146	70	27	5
Live weight, lb	939	965	1044	1171	1237	1315
Adjusted live weight, lb <sup>a</sup>	834	850	928	1047	1117	1186
Weight/height, lb/in	18.5	19.3	20.8	23.2	24.3	25.9
Adjusted weight/height, lb/in	16.5	17.0	18.5	20.8	21.9	23.3
Hip height, in	50.6	50.0	50.1	50.4	50.8	50.8
No. of cows	10	37	91	33	14	4
Backfat, in	.02	.02	.04	.07	.11	.25

<sup>a</sup> Adjusted for weight of conceptus.

TABLE 2. MEAN LIVE ANIMAL MEASUREMENTS TAKEN IN MAY BY CONDITION SCORE

Live animal measurement	Condition score						
	1	2	3	4	5	6	7
No. of cows	7	31	70	98	82	14	8
Live weight, lb	744	804	845	883	960	983	1035
Weight/height, lb/in	14.9	16.1	16.7	17.6	19.0	19.6	20.4
Hip height, in	50.5	49.9	50.4	50.1	50.4	50.1	50.7
No. of cows	2	11	51	66	52	10	7
Backfat, in	.00	.00	.01	.02	.05	.07	.12

TABLE 3. MEAN LIVE ANIMAL MEASUREMENTS TAKEN IN JUNE BY CONDITION SCORE

Live animal measurement	Condition score					
	2	3	4	5	6	7
No. of cows	6	32	106	130	30	9
Live weight, lb	855	902	946	996	1132	1138
Weight/height, lb/in	16.9	17.9	18.8	19.8	22.3	22.5
Hip height, in	50.5	50.4	50.2	50.1	50.5	50.5
No. of cows	0	15	55	98	22	7
Backfat, in		.01	.02	.03	.05	.10

Positive correlations ( $P < .001$ ) were found between condition scores, backfat probes and weight/height ratios in March and May (Tables 4 and 5). Adjusting weight/height ratios for weight of the conceptus did not increase the correlation with condition score or backfat.

TABLE 4. PARTIAL CORRELATION COEFFICIENTS BETWEEN CONDITION SCORE AND LIVE ANIMAL MEASUREMENTS IN MARCH<sup>a</sup>

	Condition score	Backfat	Weight/height ratio
Backfat	.59*		
Weight/height ratio	.74*	.46*	
Adjusted weight/height ratio	.73*	.44*	.96*
Live weight	.62*	.42*	.97*

<sup>a</sup> Model included year as an independent variable.

\*  $P < .001$ .

TABLE 5. PARTIAL CORRELATION COEFFICIENTS BETWEEN CONDITION SCORE AND LIVE ANIMAL MEASUREMENTS IN MAY<sup>a</sup>

	Condition score	Backfat	Weight/height ratio
Backfat	.62*		
Weight/height ratio	.67*	.37*	
Live weight	.58*	.35*	.97*

<sup>a</sup> Model included year as an independent variable.

\*  $P < .001$ .

The relationships between condition score and backfat and weight/height ratio in March, May and June were linear (Table 6). Backfat measurements increased quadratically as weight/height ratios increased. Equations used to estimate weight/height ratios by condition score had the highest predictive value or  $R^2$ . Correcting weight/height ratios for conceptus weight did not improve the prediction equation. This could be due to the narrow range of calving dates causing only a small variation in cow weight due to day of gestation. Equations using weight/height ratio to determine cow backfat had lower  $R^2$  values and had especially low predictive values in May and June when a high percentage of cows had little or no fat cover.

TABLE 6. EQUATIONS USED TO DETERMINE THE RELATIONSHIP BETWEEN  
CONDITION SCORE, BACKFAT AND WEIGHT/HEIGHT RATIO<sup>a</sup>

Month	Prediction equation	R <sup>2</sup>
March	$W/H = 3.7 + 3.3 (CS)$	.56
	$\text{Adjusted } W/H = .9 + 3.4 (CS)$	.53
	$BF = -.42 + .09 (CS)$	.36
	$BF = .53 - .058 (W/H) + .0017 (W/H)^2$	.29
May	$W/H = 7.3 + 2.55 (CS)$	.43
	$BF = -.17 + .048 (CS)$	.44
	$BF = -.04 + .0035 (W/H) + .00002 (W/H)^2$	.06
June	$W/H = 3.77 + 3.36 (CS)$	.41
	$BF = -.31 + .07 (CS)$	.23
	$BF = .19 - .0185 (W/H) + .00053 (W/H)^2$	.05

<sup>a</sup> CS = condition score; BF = backfat in inches, W/H = weight/height in lb/inch.

When using weight/height ratios, conceptus weights and gut fill differences between animals must be considered. In this study a high percentage of thin cows in May and June had nearly immeasurable amounts of fat cover as detected by backfat probes which limited its use as an indicator of cow body condition. Condition scores and weight/height ratios were closely related. Prediction equations reported could be used to convert condition scores to weight/height ratios.