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PROGRESS REPORT

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Effects of Crude Protein Concentration in the Receiving Diet on Performance and Health of Newly Received Beef Calves[1]

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The effects of dietary crude protein (CP) concentration on the performance by beef cattle have been evaluated at a number of research locations, but a recent review of the literature (Galyean et al., 1993) indicated that definitive recommendations for CP concentration in the diet of newly received, highly stressed beef calves are not available. Hence, the present experiment was conducted to determine the effects of different CP concentrations in the receiving diet on health and performance of newly received calves.

One hundred twenty calves were purchased in Tennessee and shipped to the Clayton Livestock Research Center. These calves were in transit for 19.5 h and experienced a 6.8% shrink from a pay weight of 428 lb. After routine processing (individually weighed, branding, Bovishield 4, seven-way clostridal, Synanthic, Tiguvon, vitamin A/D_3 injection), calves were assigned randomly to one of three diets (four pens of 10 calves per treatment) with formulated CP concentrations of 12, 14, or 16% (Table 1). In addition to the 65% concentrate diets, small bales of wheat hay were offered in a separate portion of the feed bunk during the first week of the 42-day experiment. All calves were weighed on days 21 and 42, and implanted with Synovex-S on d 21. Calves were evaluated visually in their pens each day of the experiment, and calves with symptoms of bovine respiratory disease (BRD) were removed from the pen for measurement of their rectal temperature. Calves that had a rectal temperature of >103 °F were treated with tilmicosin phosphate (Micotil) at 450 mg/100 lb of body weight. Three calves died during the 42-day receiving period, two from BRD and one from an unknown cause(s).

To determine if receiving diet CP concentration would affect subsequent performance, calves remained in their respective pens following the 42-day receiving period and were fed a common 14% CP diet. Concentrate (steam-flaked corn base) level of this diet was 75% during the first week after the receiving period, after which the calves were stepped-up to an 85% concentrate diet, which they were fed for the remainder of this 42-day post-receiving period. One calf became ill (loss of motor skills) during the post-receiving period and was removed from the experiment; this calf subsequently recovered.

Performance data were analyzed as a completely random design with pen as the experimental unit. Linear and quadratic effects of dietary CP concentration were tested. Morbidity data for individual calves were analyzed by non-parametric procedures.

Results of the experiment are shown in Table 2. Increasing CP concentration numerically increased gain during the first 21-day period, but not until the second 21-day period did this effect become statistically significant (linear effect of CP concentration, $P < .05$). Because of the large effect of CP concentration in the second half of the experiment, daily gain increased linearly ($P < .05$) for the overall 42-day receiving period as CP concentration increased from 12 to 16%. Feed intake tended to increase linearly as CP concentration increased during both the first and second 21-day periods of the receiving phase, with a linear increase ($P < .10$) for the overall 42-day period. Hence, effects of CP concentration on gain primarily reflected greater feed intake with increasing CP concentration. Percentage of calves treated for symptoms of BRD was 35.8% overall, with more ($P < .03$) calves requiring treatment on the 16% CP (47.5%) than on the 14% CP diet (22.5%); morbidity was intermediate for calves fed the 12% CP diet (37.5%), but tended ($P < .15$) to be greater than with the 14% CP diet.

Table 1. Ingredient composition of the 65% concentrate receiving diets with different protein concentrations (dry matter basis)

	Dietary CP concentration, %		
Ingredient	12	14	16
	%		
Sudangrass hay	17.92	17.92	17.92
Alfalfa hay	17.55	17.56	17.56
Whole corn	10.70	9.71	8.70
Steam-flaked corn	42.86	38.88	34.90
Soybean meal	-	4.95	9.91
Molasses	4.91	4.91	4.92
Fat	1.99	2.00	2.00
Limestone	.74	.74	.75
Dicalcium phosphate	.49	.49	.49
Salt	.35	.35	.35
Urea	.24	.24	.24
Ammonium sulfate	.24	.24	.25
Premix[a]	2.01	2.01	2.01

[a]Hominy feed-based premix supplied trace mineral mixture (.1% of diet), Rumensin (22 mg/kg), Tylan (11 mg/kg), Vitamin A (2,499 IU/kg of diet), and Vitamin E (99 IU/kg of diet). Trace mineral composition: 4.4% Mn, 12% Zn, 6.6% Fe, 1.3% Cu, .3% I, .2% Co, and 20% Mg.

Results for the 42-day post-receiving period (Table 2) indicated that calves fed the 12% CP diet during the receiving period compensated during the 42-day post-receiving phase, such that their daily gain was numerically greater during this time. For the overall 84-day period, daily gain, dry matter intake, and feed-to-gain ratio were numerically superior for calves that had been fed the 14 and 16% CP diets during the receiving phase.

Based on these results, 14% CP in a 65% concentrate receiving diet provided optimum performance and health responses by newly received, highly stressed beef calves (approximately 400 lb of body weight). The quantity of CP required by newly received calves is a function of feed intake, body weight, and daily gain. Hence, the optimum CP concentration could vary with type of diet fed during the receiving period, level of feed intake, type and weight of calf, and other management procedures.

Literature Cited

Galyean, M. L., K. J. Malcolm-Callis, and S. A. Gunter. 1993. Nutritional strategies for newly received cattle. In: Proc. of the 23rd Annual AFIA Liquid Feed Symposium. pp 147-170. September 13-15, Denver, CO. American Feed Industry Association, Arlington, VA.

[1]We thank Syntex Anim. Health for supplying Synanthic and Synovex S implants and Elanco Anim. Health for supplying Micotil, Rumensin, and Tylan.

Table 2. Influence of protein concentration on performance by calves during a 42-day receiving period and subsequent 42-day post-receiving period

Item	Dietary CP concentration, %			Contrast[a]	SE[b]
	12	14	16		
Receiving period performance, d 0 to 42					
No. of calves	40	40	40	-	-
Initial BW, kg	412.4	409.2	403.3	-	2.6
42-d BW, kg	520.1	536.6	537.2	-	5.5
Daily gain, kg					
d 0 to 21	1.50	1.85	1.97	NS	.34
d 22 to 42	3.52	4.23	4.40	L*	.21
d 0 to 42	2.51	3.04	3.19	L*	.11
Daily dry matter intake, kg/steer					
d 0 to 21					
Hay	1.34	1.36	1.34	NS	.05
Concentrate	5.84	6.36	6.67	NS	.34
Hay + concentrate	7.17	7.72	8.01	NS	.35
d 22 to 42	12.55	12.40	13.30	NS	.39
d 0 to 42	9.86	10.06	10.65	L+	.27
Feed-to-gain					
d 0 to 21	5.64	4.72	4.35	NS	.94
d 22 to 42	3.61	2.95	3.04	L*	.17
d 0 to 42	3.95	3.32	3.35	Q*	.08
Calves treated for BRD, %[c]	37.5	22.5	47.5	-	-
Mortality, no.	2	1	0	-	-
Post-receiving performance, d 42 to 84					
Daily gain, lb	3.49	3.40	3.21	NS	.18
Daily dry matter intake, lb/steer	15.37	15.76	15.49	NS	.47
Feed-to-gain	4.44	4.66	4.83	NS	.16
Overall performance, d 0 to 84					
Daily gain, lb	3.00	3.22	3.20	NS	.12
Daily dry matter intake, lb/steer	12.62	12.91	13.07	NS	.33
Feed-to gain	4.23	4.01	4.09	NS	.09

[a]Orthogonal contrasts: L = linear, Q = quadratic effect of protein concentration.

[b]Standard error, n = four pens per treatment.

+P < .10.

*P < .05.

[c]Distribution differs; for 12 vs 14% CP, P < .15; for 14 vs 16% CP, P < .03.

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