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Effect of milk intake and method of weaning on calf performance and stress in an early-weaning program

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EFFECT OF MILK INTAKE AND METHOD**OF WEANING ON CALF PERFORMANCE AND STRESS****IN AN EARLY-WEANING PROGRAM**

Paula Flynn, P.G. Reddy, J.L. Morrill,
and J.S. Stevenson

Summary

Feeding milk at 8% of birthweight and gradual weaning resulted in the most consistent increases in weekly weight gain, highest overall weight gain, and greatest increases in dry feed consumption during an 8-wk trial compared to feeding milk at 8% and abrupt weaning, at 10% and gradual weaning, or at 10% and abrupt weaning. By 8 wk, the 8% gradually-weaned calves also had higher levels of serum protein and lower levels of urea nitrogen in blood than calves in other treatment groups. Therefore, the 8% gradual-weaning program was determined to be the most appropriate for early weaning of dairy calves.

Introduction

The amount of feed a calf will consume and its ability to utilize that feed efficiently dictate when it can be weaned. Dry feed and the resulting products of fermentation are responsible for the development of the rumen. Stimulation of the calf to consume dry feed at a young age, thus, causing it to develop a functional rumen early in life should allow for earlier weaning. However, there is controversy as to the appropriate level of milk that allows for both optimal stimulation of dry feed consumption and growth. Feeding a high level of milk will cause an initial increase in growth, but may depress dry feed consumption of the calf, which eventually may result in unsatisfactory growth rates. Feeding a lower level of milk, though producing early slower gains, may cause the calf to begin consuming dry feed at an earlier age, allowing for earlier rumen development and eventually resulting in greater gains.

Weaning is a well known stressor to the calf. Abrupt weaning may initially present a great deal of stress to the calf, but in turn cause it to increase dry feed consumption at a faster rate. Gradual weaning may be less stressful than abrupt weaning, but may delay first dry feed consumption.

The following experiment was designed to determine which level of milk, 8% or 10% of birth weight, and which type of weaning regimen, abrupt or gradual, would result in the greatest productivity and least stress for the early-weaned calf.

Procedures

Forty calves were assigned to receive daily diets of milk fed in two equal daily portions at either 8% or 10% of birth weight. Calves were then weaned abruptly or gradually. Calves were stimulated with an all-milk prestarter, which was offered ad libitum to a maximum of 0.5 lb per day, after which calves were fed 0.5 lb prestarter per day and as much starter (16% protein) as they would consume. Feed was weighed back daily, fecal consistency and general appearance were scored twice daily, and calves were weighed weekly. Abruptly weaned calves were weaned at 3 wk of age or when consuming 0.5 lb dry feed, whichever came first. Gradually weaned calves were weaned using the same criteria; however, they were fed their A.M. portion of milk for 1 additional wk. Blood was collected and analyzed for cortisol, blood metabolites, and lymphocyte stimulation index at various times during the 8-wk trial. In 16 calves (four/treatment), 1.03 IU adrenocorticotropin (ACTH)/ kg metabolic body weight was administered at 4 wk of age to assess adrenal function as a measure of stress by monitoring cortisol in serum.

Results and Discussion

Dry feed consumption and body weights during the trial are shown in Tables 1 and 2, respectively. Excluding wk 4, the 8%, gradually-weaned calves ate more dry feed than calves in any other group. After wk 4, these calves also weighed more. There were no differences in fecal scores among treatments. Overall, the lymphocyte stimulation index, which is used as an indicator of the calf's ability to resist disease, and cortisol levels, which are used as an indicator of stress, were both highly variable and no difference among treatments was seen. Cortisol levels, however, were lower for the gradually weaned calves than for abruptly weaned calves 24 h after weaning, indicating that the gradually weaned calves were less stressed than the abruptly weaned calves at that time. Serum protein was higher in 8% gradually-weaned calves at 4 and 8 wk of age than in other groups. Blood urea nitrogen was lowest for the 8% gradually-weaned group at 8 wk of age, possibly indicating better rumen function for these calves.

Table 1. Weekly dry feed consumption (pounds)

Treatment	Weeks of Age								Trial Mean
	1	2	3	4	5	6	7	8	
8%-Abrupt	1.1	1.5	4.4 ^{ab}	12.5 ^b	20.9 ^{ab}	29.5 ^b	31.5 ^a	33.2 ^a	16.9 ^b
8%-Gradual	1.3	2.0	6.2 ^b	12.1 ^b	22.9 ^b	30.4 ^b	35.9 ^b	38.7 ^b	18.7 ^c
10%-Gradual	.7	1.1	2.9 ^a	7.7 ^a	18.1 ^a	26.0 ^a	30.8 ^a	33.0 ^a	15.0 ^a
10%-Abrupt	1.1	1.5	3.9 ^{ab}	10.6 ^b	19.1 ^a	25.5 ^a	32.6 ^a	35.6 ^a	16.3 ^b

a,b,c Means within column with unlike superscript differ ($P < .05$)

Table 2. Weekly body weight (pounds)

Treatment	Birth	Weeks of Age								Trial Mean
		1	2	3	4	5	6	7	8	
8%-Abrupt	88	92 ^{ab}	94 ^{ac}	98 ^a	103 ^a	113 ^a	127 ^a	138 ^a	149 ^a	111 ^a
8%-Gradual	92	94 ^{bc}	97 ^{bc}	105 ^b	113 ^b	124 ^b	137 ^c	152 ^c	168 ^c	120 ^c
10%-Gradual	84	87 ^a	91 ^a	97 ^a	104 ^a	111 ^a	123 ^a	137 ^a	149 ^a	109 ^b
10%-Abrupt	94	99 ^c	101 ^b	109 ^b	110 ^b	119 ^b	132 ^b	147 ^b	160 ^b	119 ^c

a,b,c Means within column with unlike superscript differ ($P < .05$)

Concentrations of cortisol in serum after the ACTH challenge are found in Table 3. The ACTH challenge involves stimulating the adrenal gland by injecting exogenous ACTH and collecting blood at specific times postinjection. These samples are then analyzed for cortisol. There was a general trend throughout treatments for levels to peak at 1.5 to 2.0 h postinjection. Calves in the 10% abruptly weaned group had the lowest concentrations of cortisol, indicating that these calves were least stressed at this time during the trial.

Table 3. Concentrations of cortisol in serum of 4-wk old calves after adrenocorticotropin (ACTH)

Treatment	Time after Injection (hours)							Mean
	0	0.5	1.0	1.5	2.0	2.45	4.0	
8%-Abrupt	4.1	18.7 ^b	18.2	17.5	20.6 ^b	16.8	13.9	15.7 ^b
8%-Gradual	2.2	16.0 ^{ab}	18.2	18.2	17.5 ^{ab}	17.9	14.5	14.9 ^b
10%-Gradual	1.4	15.4 ^{ab}	16.8	19.0	18.1 ^{ab}	17.5	14.2	14.6 ^b
10%-Abrupt	2.7	12.5 ^a	14.0	15.7	13.1 ^a	13.9	13.4	12.2 ^a

a,b Means within column with unlike superscript differ ($P < .05$)

Recommendations

Results of this trial indicate that milk fed at 8% of birth weight and gradual weaning produced the most beneficial results in an early weaning program.