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Effect of rumen degradability of protein and fat on the growth and development of dairy calves

Abstract

Sixty heifer and 34 bull calves were fed starter diets containing either control or extruded soybean meal (SBM) and either 2.5% or no bypass fat from birth to 8 wk of age. There were no interactions between the type of SBM and the amount of fat. There were no significant differences between the calves fed control or extruded SBM with or without fat supplementation, although the trends favored the calves fed extruded SBM with no bypass fat.; Dairy Day, 1990, Kansas State University, Manhattan, KS, 1990; The 1990 Annual KSU Dairy Day is known as Dairy Day, 1990

Keywords

Dairy Day, 1990; Kansas Agricultural Experiment Station contribution; no. 91-148-S; Report of progress (Kansas Agricultural Experiment Station); 608; Rumen degradability; Protein; Fat; Growth; Dairy calves

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EFFECT OF RUMEN DEGRADABILITY OF PROTEIN AND FAT ON THE GROWTH AND DEVELOPMENT OF DAIRY CALVES

D. E. Isbell and J. L. Morrill

Summary

Sixty heifer and 34 bull calves were fed starter diets containing either control or extruded soybean meal (SBM) and either 2.5% or no bypass fat from birth to 8 wk of age. There were no interactions between the type of SBM and the amount of fat. There were no significant differences between the calves fed control or extruded SBM with or without fat supplementation, although the trends favored the calves fed extruded SBM with no bypass fat.

Introduction

Increasing the energy intake of young calves is difficult because of the limitation of feed consumption. Because fat is so high in energy, it could be added to calf starters to increase energy intake, if feed intake were not depressed. Addition of too much fat is known to depress consumption; however, if some of the fat bypassed the rumen, normal consumption might be maintained even when fat is added.

In some cases, it is advantageous to have part of the dietary protein escape rumen fermentation. In this way, the value of high quality protein can be maintained and the amount of protein nitrogen converted to ammonia, and possibly lost, can be reduced. Increasing the amount of protein that escapes ruminal degradation could result in improved protein nutrition or allow decrease of dietary protein.

This experiment was conducted to evaluate the effect of increasing the amount of dietary protein that escaped rumen degradation by extrusion processing of soybean meal (SBM) and of adding rumen-inert fat to calf starters.

Procedures

Sixty heifer and 34 bull calves were used from birth to 8 wk of age. They were fed colostrum for 3 d and then whole milk and could consume calf starter ad libitum. Calves were weaned when they had eaten 1.5 lb or more starter for 3 consecutive days.

The calves were assigned to blocks of four by age, then calves within a block were assigned randomly to one of four starter diets, which were formulated to contain no rumen bypass fat¹ with either

¹Energy Booster 100™, Milk Specialties Co., Dundee, IL 60118.

control SBM (group 1) or extruded SBM² (group 2) or 2.5% rumen bypass fat with either control SBM (group 3) or extruded SBM (group 4).

The amount of starter diet each calf consumed was recorded daily. Twice daily, each calf was assigned a value for general appearance and consistency of feces (1, normal to 4, watery). All calves were weighed weekly. At birth and at 8 wk of age, wither height, length, and heart girth measurements were recorded. At 8 wk of age, blood was collected for metabolic evaluation using the SMA-12 analysis, which measures 14 blood metabolites.

Results and Discussion

There were no significant interactions between type of protein supplement and energy concentration for any of the factors measured.

Feed consumption

Average weekly feed consumption is shown in Figure 1. From wk 5 through wk 8, groups 3 and 4 tended to consume less feed than groups 1 and 2, with consumption of group 4 being less ($P<.05$) than that of group 2 at wk 8. Starting at wk 3, there was a trend for group 2 to consume more feed than the other three groups during each week. Total feed consumption for the 8-wk period was 111, 117, 108, and 108 lb for groups 1, 2, 3, and 4, respectively.

Weight gain

Average weekly gains for the four groups are shown in Figure 2. There were no differences in gains except at wk 5, when group 2 gained more ($P<.01$) than group 3. Total gains for the 8-wk period were 70, 72, 68, and 69 lb for groups 1, 2, 3 and 4, respectively.

Fecal scores

There were no significant differences in fecal scores among the four groups for any of the weeks during the 8-wk trial. The average fecal scores for the 8 wk were 1.2, 1.2, 1.2, and 1.2 for 1, 2, 3, and 4, respectively.

Body measurements

Body measurements for the four groups are shown in Table 1. There were no differences in wither height at birth. At 8 wk, groups 3 and 4 were shorter ($P<.05$) than group 1. There were no statistical differences in the increase in wither height from birth to 8 wk, but groups 1 and 2 grew more than groups 3 and 4.

There were no significant differences in either length of body or heart girth measurements at birth or at 8 wk and no differences in the increase in length or heart girth from birth to 8 wk.

²Extruded at 300° F with an Insta Pro Dry Extruder, Model 2000. Triple F Products, Des Moines, IA 50322.

Blood metabolites

The serum sodium concentration of group 1 was less ($P < .05$) than that of group 4. The reason for this is not apparent. There were no other differences between the four groups for any of the other metabolites.

There were no statistical differences between the growth of calves that received the bypass fat and those that did not. However, the trend favored the calves not receiving additional fat. They tended to have higher gains (71 vs 68 lb), higher feed consumption (114 vs 108 lb), and greater increases in wither height (3.4 vs 3.0 in) and heart girth (6.6 vs 6.2 in).

There were no statistical differences between calves on the extruded and control SBM. However, calves that received the extruded SBM tended to have higher feed consumption (112 vs 110 lb), higher gains (70 vs 68 lb), and a greater increase in length (5.0 vs 4.4 in).

The reason for lack of response to added fat is not known. Possibly, the response would have been different if smaller amounts of fat had been added or different feed mixtures had been used. Further research is underway to study the effect of adding various types of fat to calf starters.

Table 1. Body Measurements of Calves in Four Treatment Groups

Item	No bypass fat		2.5% bypass fat		SE
	1 ¹	2 ²	3 ¹	4 ²	
Height					
Birth	29.8	29.4	29.2	29.3	0.70
8 wk	33.1 ^a	32.9 ^{ab}	32.0 ^b	32.2 ^b	0.78
Increase	3.3	3.5	2.8	2.9	0.63
Length					
Birth	28.7	28.4	28.2	28.2	0.82
8 wk	32.9	33.7	32.9	33.1	0.94
Increase	4.2	5.3	4.7	4.9	1.06
Heart girth					
Birth	31.5	31.1	31.1	30.9	0.98
8 wk	37.9	37.8	37.4	37.0	1.06
Increase	6.4	6.7	6.3	6.1	0.80

^{a,b} Means in same row with different superscripts differ significantly ($P < .05$).

¹Starter contained control SBM.

²Starter contained extruded SBM.

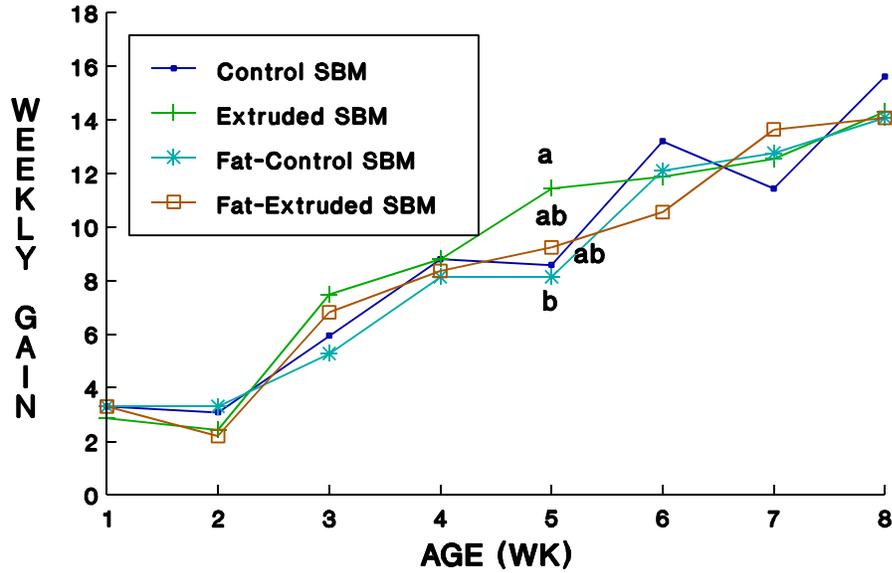


Figure 1. Feed consumption (lb) of calves in four treatment groups (see text). Means within a week with different superscripts differ ($P < .05$).

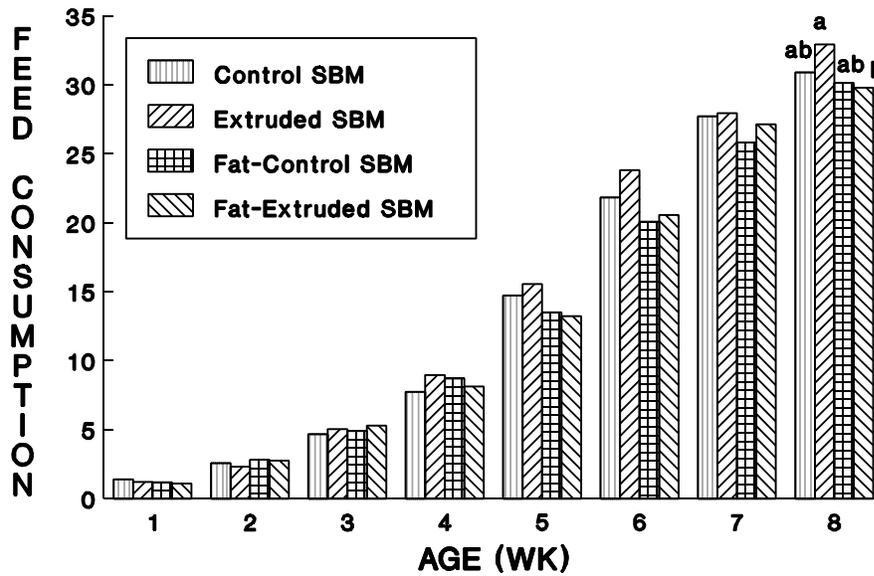


Figure 2. Weekly gains (lb) of calves in four treatment groups (see text). Means within a week with different superscripts differ ($P < .01$).