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Evaluation of performance in receiving heifers fed different sources of dietary lipid

Abstract

Two 35-day receiving experiments were conducted using 668 highly stressed crossbred beef heifers to evaluate differences in growth performance, morbidity, and mortality when fed diets containing differing sources of dietary lipid. Heifers received diets containing beef tallow, tallow enriched with a microalgae product containing a high proportion of docosahexaenoic acid (an omega-3 fatty acid), full-fat soybeans, or ground flaxseed. All diets contained approximately 60% concentrate and 40% roughage (alfalfa hay). Feed intake, daily gain, and feed efficiency were poorer ($P<0.05$) for cattle fed full-fat soybeans than for those fed the other treatments. Feed intake tended to be reduced when micro-algae was top-dressed to the diet, but gain was not negatively impacted. In Trial 2, feed efficiency was improved by the micro-algae. No notable differences among treatments were evident in the percentage of cattle treated for bovine respiratory disease, but cattle fed flaxseed tended to respond better to therapeutic treatments, requiring fewer retreatments.

Keywords

Cattlemen's Day, 2002; Kansas Agricultural Experiment Station contribution; no. 02-318-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 890; Beef; Receiving cattle; Dietary lipid

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EVALUATION OF PERFORMANCE IN RECEIVING HEIFERS FED DIFFERENT SOURCES OF DIETARY LIPID[1]

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Summary

Two 35-day receiving experiments were conducted using 668 highly stressed crossbred beef heifers to evaluate differences in growth performance, morbidity, and mortality when fed diets containing differing sources of dietary lipid. Heifers received diets containing beef tallow, tallow enriched with a micro-algae product containing a high proportion of docosahexaenoic acid (an omega-3 fatty acid), full-fat soybeans, or ground flaxseed. All diets contained approximately 60% concentrate and 40% roughage (alfalfa hay). Feed intake, daily gain, and feed efficiency were poorer ($P<0.05$) for cattle fed full-fat soybeans than for those fed the other treatments. Feed intake tended to be reduced when micro-algae was top-dressed to the diet, but gain was not negatively impacted. In Trial 2, feed efficiency was improved by the micro-algae. No notable differences among treatments were evident in the percentage of cattle treated for bovine respiratory disease, but cattle fed flaxseed tended to respond better to therapeutic treatments, requiring fewer retreatments.

(Key Words**:** Lipids, Receiving Cattle.)

Introduction

The health of weaned calves is often challenged by dramatic stresses such as pathogen exposure, dehydration, food deprivation, commingling, transportation, and climatic changes. These factors can result in multi-faceted diseases such as Bovine Respiratory Disease (BRD). BRD causes enormous economic losses for the U.S. beef industry. Lung damage from the disease can have lasting detrimental effects on animal performance and carcass value or even result in death of the animal. Gram-negative bacteria are the most common and damaging pathogens involved in BRD. Gram-negative bacterial infections are characterized by the animals' reaction to components of the bacterial cell wall, frequently resulting in elevated body temperature and production of a variety of compounds that cause exaggerated inflammatory responses. These inflammatory substances can cause irreversible damage to lung tissues, thereby compromising disease resistance and future productivity of the animal. Nutrition of the animal plays an important role in reducing susceptibility to disease. Some fatty acids (omega-3) have potent anti-inflammatory and immunomodulatory effects, which may prove beneficial when fed to highly stressed feeder calves. Consequently, we designed these studies to compare performance of stressed feeders fed receiving diets containing varying sources of dietary lipid. Treatments consisted of diets containing lipid from rolled full-fat soybeans (SOY), ground flaxseed (FLAX), tallow (TALLOW), and algae (ALGAE).

[1]This research was supported by a grant from the North Dakota Oilseed Council.
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Experimental Procedures

Crossbred heifer calves (n = 688) were used in two receiving experiments to evaluate growth performance, morbidity, and mortality when fed diets containing different lipid sources. Dietary treatments (Table 1) were composed of a corn/alfalfa hay-based diet with added tallow (TALLOW), ground flaxseed (FLAX), rolled full-fat soybeans (SOY), or micro-algae top-dressed (ALGAE) on the TALLOW diet. The micro-algae contained a high proportion of docosahexaenoic acid. In Trial 1, algae was top-dressed to provide docosahexaenoic acid at 9.4 g/day for the first 10 days, 6.2 g/day for the second 10 days, and 3.2 g/day for the remaining 15 days. The amount of ALGAE top-dressed onto the ration was modified in Trial 2 to avoid what appeared to be an adverse effect on feed consumption within the first few days after arrival in the feedyard. In Trial 2, ALGAE was top-dressed to provide docosahexaenoic acid at 5.2 g/day for the first 10 days, 8.6 g/day for the second 10 days, and 5.0 g/day for the remaining 15 days.

Calves were purchased from sale barns in Kentucky and Tennessee and transported to the KSU Beef Cattle Research Center in Manhattan. Upon arrival at the feedlot, calves were allowed free choice access to long-stem prairie hay and water and were processed within 24 hours. Body weight and rectal temperature were recorded and heifers were administered Bovishield®-IV, Fortress®-7, Cydectin®, and a Ralgro® implant. Additionally, heifers were given a metaphylactic dose of Micotil® at 1.5 ml per 100 lb BW. A second dose of Bovishield-IV was administered 7 days after initial processing, and at this time rectal temperature and body weight were recorded. Calves were allotted randomly to treatments in each study and placed into pens containing 6 to 7 heifers each. Each experiment contained 13 pens per treatment. Heifers were fed their respective diets (Table 1) once daily throughout the 35-day experiments.

Animals that exhibited clinical signs of undifferentiated bovine respiratory disease (BRD) were identified each morning as candidates for therapeutic treatment. They were treated for BRD if clinical signs were accompanied by a rectal temperature of $\geq$103.5ºF or if they exhibited clinical signs of BRD for two consecutive days. The initial therapeutic treatment consisted of a subcutaneous injection of Micotil at 1.5 ml/100 lb BW. Heifers were returned to their home pen following treatment. In Trial 1, calves were retreated after 48 hours when clinical signs of BRD were accompanied by a rectal temperature of $\geq$103.5ºF. In Trial 2 calves were retreated after 48 hours, regardless of rectal temperature. Third-time treatment for both trials was a combination of 6 ml/100 lb BW LA-200® subcutaneously, and 5 ml/100 lb BW Tylan® intramuscularly.

Calves were weighed at the end of the 35-day receiving trials. Average daily gains and efficiencies were computed using the initial weight at processing, the 7-day weight at re-vaccination, and the final weight, all of which were measured approximately 24 hours after feeding.

Results and Discussion

Performance during the two 35-day receiving experiments is summarized in Table 2. In Trial 1, gain during the first 7 days was lowest for SOY and ALGAE. Feed efficiency and average daily gain for the entire receiving period were poorer ($P<0.05$) for SOY when compared to TALLOW, FLAX, and ALGAE. Feed intake for SOY was numerically the lowest, but not significantly different from ALGAE.

In Trial 2, gain during the first 7 days was lowest for SOY, but not different than ALGAE (P=0.26). Average daily gain over the entire receiving period was lowest (P<0.002) for SOY when compared to FLAX, TALLOW, and ALGAE. Feed efficiency was poorest (P<0.004) for SOY and best for ALGAE, however ALGAE was not different than FLAX (P=0.45). Feed intake was highest for FLAX, though it was not significantly different from TALLOW.

The percentage of animals that received therapeutic treatment for undifferentiated bovine respiratory disease did not vary greatly among experimental diets. Moreover, we conclude that feeding full-fat soybeans to receiving cattle can decrease growth performance during the first 35-days after arrival. These studies indicate that the source of dietary lipid may impact growth performance, feed intake, and efficiency in different ways. However, the incidence of BRD was not greatly affected by dietary treatment.

Table 1. Composition of Receiving Diets in Trials 1 and 2 (100% Dry Basis)

Ingredient, %	TALLOW	FLAX	SOY	ALGAE
Steam-flaked corn	32.9	29.4	32.7	32.9
Alfalfa hay	39.4	39.4	39.5	39.4
Dehulled soybean meal	15.9	10.5	-	15.9
Flaxseed, ground	-	12.9	-	-
Full-fat soybeans, rolled	-	-	20.0	-
Micro-algae[a,b]	-	-	-	daily top-dress
Molasses, cane	4.8	4.8	4.8	4.8
Tallow	4.0	-	-	4.0
Ground corn	2.67	2.67	2.67	2.67
Salt	0.27	0.27	0.27	0.27
Vitamin/mineral premix[c]	0.06	0.06	0.06	0.06
Estimated nutrients[d]				
Trial 1				
Crude protein	18.4	18.6	18.5	18.4
Caclium	0.80	0.80	0.81	0.80
Phosphorus	0.40	0.42	0.37	0.40
Trial 2				
Crude protein	19.2	19.3	19.0	19.2
Calcium	0.66	0.68	0.67	0.66
Phosphorus	0.33	0.36	0.32	0.33

[a]Top-dressed to provide docosahexaenoic acid at 9.4 g/day for the first 10 days, 6.2 g/day for the next 10 days, and 3.2 g/day for the last 15 days per heifer in Trial 1.
[b]Top-dressed to provide docosahexaenoic acid at 5.2 g/day for the first 10 days, 8.6 g/day for the next 10 days, and 5.0 g/day for the last 15 days per heifer in Trial 2.
[c]Provided 1000 IU/lb vitamin A, 0.1 ppm Co, 10 ppm Cu, 0.60 ppm I, 60 ppm Mn, 0.1 ppm Se, 60 ppm Zn, and 25grams/ton Rumensin on a dry basis.
[d]Estimated from analysis of individual feed ingredients.

Table 2. Performance of Feeder Heifers Fed Receiving Diets Containing Different Sources of Dietary Lipid

	Dietary Treatment				
Item	TALLOW	FLAX	SOY	ALGAE	SEM
Trial 1					
No. pens (heifers)	13 (83)	13 (83)	13 (83)	13 (83)	
Dry matter intake, lb/day	10.45[a]	10.40[a]	9.03[b]	9.93[ab]	0.45
Gain, days 1 to 7, lb/day	1.70[a]	1.80[a]	0.60[b]	0.50[b]	0.38
Gain, days 1 to 35, lb/day	2.74[a]	2.81[a]	2.02[b]	2.60[a]	0.17
Feed:Gain, days 1 to 35	3.81[a]	3.76[a]	4.50[b]	3.84[a]	
Therapeutic treatments, %	50.0	51.1	53.5	50.7	6.2
Retreatments, %	29.1	18.7	27.3	22.7	5.2
Trial 2					
No. pens (heifers)	13 (84)	13 (84)	13 (84)	13 (84)	
Dry matter intake, lb/day	10.35[ab]	10.60[a]	9.55[c]	9.83[bc]	0.26
Gain, days 1 to 7, lb/day	0.85[a]	1.33[a]	-0.12[b]	0.48[ab]	0.38
Gain, days 1 to 35, lb/day	2.65[a]	2.87[a]	2.09[b]	2.75[a]	0.12
Feed:Gain, days 1 to 35	3.90[ad]	3.71[a]	4.61[b]	3.58[ae]	
Therapeutic treatments, %	70.9	72.9	68.9	67.2	4.3
Retreatments, %	37.7	40.8	38.5	41.9	6.3

[a,b,c]Means in a row not bearing a common superscript are different ($P<0.05$).
[d,e]Means in a row not bearing a common superscript tend to be different ($P<0.1$).