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Effects of Omega-3 Fatty Acid Supplementation on Growth and Development of Bull Calves

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Abstract

An omega-3 fatty acid supplement was fed to spring-born purebred growing bulls (n = 42) developed in an automated feed intake system. Diets were generated using the Beef Ration and Nutrition Decision Software (BRaNDS) feed formulation package (Iowa State University, Ames, IA). The bulls were weaned in the fall and entered the Kansas State University Precision Feed Intake Facility, where they were fed a total mixed ration. Feed intake was recorded by the Insentec system for 64 days. The bulls were randomly assigned to three groups that included a control that did not receive the omega-3 supplement (n = 14), and calves that received 0.5 lb (n = 14) or 1.0 lb (n = 18) of the omega-3 supplement. No differences ($P = 0.64$) were found for dry matter intake (DMI) among treatment groups. However, bulls in the 1.0 lb treatment group had higher ($P = 0.04$) average daily gain (ADG) compared to the control group. Feed-to-gain ratios (F:G) were not different ($P = 0.72$) among groups. Scrotal circumference (SC) and final body weight also showed no differences ($P > 0.05$). The probability of passing the breeding soundness exam (BSE) was lower ($P = 0.0097$) in the 1.0 lb treatment group compared to the control group. These results suggest that while omega-3 supplementation at 1.0 lb/day improved weight gain, it may have negatively impacted reproductive soundness, as indicated by lower BSE pass rates.

Introduction

The post-weaning period is a critical developmental phase for beef bulls, during which nutrition plays a vital role in their growth and reproductive performance. After weaning, typically around 7 months of age, bulls experience rapid growth and development before their introduction to females for breeding at approximately 15 months. This developmental window is essential for ensuring long-term reproductive success and the overall viability of the animal. Much research has focused on the post-weaning nutrition of beef heifers; comparatively less attention has been given to beef bulls, particularly regarding how nutritional supplementation may influence growth, feed intake, efficiency, and sexual development characteristics.

Understanding the impact of dietary fatty acids on bulls during this period could have substantial implications for the beef industry. The objective of this study was to evaluate the effect of supplemental omega-3 fatty acids on post-weaning beef bulls. Specifically, this study aimed to assess the influence of dietary fatty acids on growth performance, including average daily gain (ADG), feed intake, and feed efficiency, and reproductive

development, including scrotal circumference (SC) and breeding soundness exam (BSE) outcomes. Given the lack of extensive research in this area, especially concerning bull development, this study seeks to contribute valuable insights that can be applied to improve the management and nutrition of growing beef bulls in production systems.

Experimental Procedures

Spring born purebred Angus, Hereford, and Simmental bull calves from the 2023 calf crop (n = 42) were utilized in this trial. All calves were born at the Kansas State University Purebred Beef Unit in the spring and raised at dam's side grazing native Flint Hills range until weaning in September each year. At weaning, bulls initially had access to native prairie hay and a commercial creep feed for *ad libitum* consumption for approximately 2 weeks before being transitioned to a total mixed ration, which was subsequently fed for 4 to 5 weeks. Following the weaning and diet transition period, bulls entered the Kansas State University Precision Feed Intake Facility in mid-November. Once at a stable intake level, bulls were randomly assigned to diet treatment groups consisting of a 0 lb (control, n = 14), 0.5 lb (n = 14), or 1.0 lb (n = 18) per head per day equivalent intake (as-is basis) of an omega 3-based fatty acid supplement top-dressed onto the basal diet. Bulls were weighed for three consecutive days at the beginning and end of the test period and averaged to determine initial and ending weight. Initial day of age and the average initial body weight (BW) were used to stratify the bulls. Treatment groups were randomly assigned to Insentec bunk module units throughout the pen and individual feed intake data were recorded. The ADG was calculated using the initial and ending weights with feed to gain ratio (F:G) subsequently calculated for each bull from average individual dry matter intake (DMI).

Each treatment group diet was created using the Growing Bull module of the Excel-based Beef Ration and Nutrition Decision Software (BRaNDS) formulation program used by Kansas State University Research and Extension as well as by other Extension services, nutritionists, and veterinarians. Ingredient composition of diets fed differed between treatment groups (Table 1). Intake and performance equations incorporated into BRaNDS were from the Nutrient Requirements of Beef Cattle 7th and 8th editions. Data were analyzed using SAS (SAS Institute Inc., Cary, NC) using the PROC GLIMMIX procedure. A *P*-value less than or equal to 0.05 was declared significant.

Results and Discussion

Initial BW averaged 776 lb across the three treatment groups, with no differences ($P = 0.98$) observed (Table 2). By the end of the study, final BW were 1,003 lb for the control group, 1,023 lb for the 0.5 lb treatment group, and 1,035 lb for the 1.0 lb group, and were not different ($P = 0.77$) between groups. Despite the lack of significance, there was a trend toward higher final weights in the 1.0 lb group, suggesting a potential effect of omega-3 supplementation on growth.

No differences ($P = 0.64$) were found in DMI between the treatment groups. Average daily DMI was similar across the control (20.6 lb), 0.5 lb (21.4 lb), and 1.0 lb (21.9 lb) groups (Table 2), indicating that the omega-3 supplementation had no effect on overall feed consumption. In terms of ADG, however, an effect ($P = 0.03$) of omega-3 supplementation was observed. Bulls in the 1.0 lb group showed higher ($P = 0.04$) ADG compared to the control group (Table 2), with mean ADG values of 3.60 lb/day for the control group, 3.89 lb/day for the 0.5 lb group, and 4.25 lb/day for the 1.0 lb group. This suggests that while omega-3 supplementation did not impact feed intake, it may

have enhanced feed efficiency, leading to greater weight gain. The F:G were similar across all treatment groups ($P = 0.72$), with no significant improvement in feed conversion efficiency observed between groups. This aligns with the observed lack of difference in DMI and suggests that the increase in ADG in the 1.0 lb group may be attributed to factors beyond simple feed efficiency. The SC was not affected ($P = 0.67$) by omega-3 supplementation. Mean SC ranged from 13.7-in in the control group to 13.6-in in the 0.5 lb group, and 13.8-in in the 1.0 lb group. This indicates that the omega-3 supplement did not affect reproductive development as measured by SC. Interestingly, the probability of passing a BSE was lower ($P = 0.03$) in the 1.0 lb treatment group compared to the control group (Table 2). While 85.46% of bulls in the control group passed the BSE, only 22.89% of bulls in the 1.0 lb group passed this exam. This finding suggests a potential negative impact of high omega-3 supplementation on reproductive health, despite the observed gains in BW. These results suggest that while omega-3 supplementation at 1.0 lb/day may enhance weight gain, it could have detrimental effects on reproductive soundness. The reduction in reproductive soundness may be attributed to disruptions in hormonal balance or other metabolic processes influenced by high omega-3 intake. The lack of significant differences in feed intake and SC further emphasizes that the reproductive outcomes may not be linked to changes in feed intake or growth traits but rather specific physiological effects of the omega-3 supplementation. Future studies should investigate the underlying mechanisms driving this trade-off between growth performance and reproductive health to better inform supplementation strategies in bull development programs.

Implications

These results suggest that while omega-3 supplementation at 1.0 lb/day improved weight gain, it may have negatively affected reproductive soundness, as indicated by lower BSE pass rates.

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Table 1. Ingredient composition of diets by treatment, percent dry matter basis

	Amount of omega-3 supplementation		
Item	**Control**	**0.5 lb**	**1.0 lb**
Corn silage	30.50	33.10	30.80
Wet corn gluten feed	29.20	27.50	26.10
Dry rolled corn	20.30	17.80	16.40
Brome hay	12.50	14.10	14.70
Supplement	7.50	7.30	7.60
Omega-3 fatty acid supplement	---	2.20	4.50

Table 2. Effects of omega-3 supplementation on growth, feed intake, and reproductive parameters in post-weaning beef bulls

	Amount of omega-3 supplementation				
Item	**0 lb**	**0.5 lb**	**1.0 lb**	**SE[1]**	***P*-value**
Initial age	292	292	291	6.25	0.99
Initial BW,[2] lb	773	774	767	42.18	0.98
End BW,[2] lb	1,003	1,024	1,035	55.04	0.77
DMI,[2] lb/day	20.6	21.4	21.9	2.14	0.64
ADG,[2] lb	3.60[a]	3.89[a]	4.25[b]	0.307	0.04
F:G[2]	5.89	5.65	5.51	0.3295	0.72
SC,[2] in	13.7	13.6	13.8	1.14	0.67
BSE[2] % Pass	85.46[a]	67.76[ab]	22.89[b]	0.183	0.03

[1] Standard deviation.
[2] BW = body weight; DMI = dry matter intake; ADG = average daily gain; F:G = feed to gain ratio; SC = Scrotal circumference; BSE = Breeding soundness exam.
[a-b] Within rows, means with unlike superscripts differ ($P \leq 0.05$).