K-STATE Research and Extension

CATTLEMEN'S DAY 2026

Effects of Short Duration Omega-3 Based Fatty Acid Supplementation to Developing Heifers on Growth, Intake, and Reproduction

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Abstract

This study evaluated the effect of short-duration omega-3 fatty acid supplementation around the time of breeding on growth performance, feed intake, and reproduction of beef replacement heifers. Weaned, spring-born heifers (n = 85) of either Angus, Simmental, or Hereford breeding were used over two years and assigned to one of two treatments each year in a completely randomized design. Heifers were allocated based on body weight (BW) and age and were either non-supplemented (NOSUPP) or supplemented with an extruded flaxseed and algae-based supplement designed to provide omega-3 fatty acids (SUPP). On a dry-matter basis, heifers in year one received 0.48 lb/head/day of the omega-3 supplement, and heifers in year two received 0.72 lb/head/day. In year one, there were 27 SUPP heifers and 26 NOSUPP heifers. In year two, there were 19 and 13 head for SUPP and NOSUPP treatment groups, respectively. Within a year, heifers were managed as a common group and individually fed a forage-based growing diet in precision intake management bunks, with the omega-3 fatty acid-based supplement mixed into the diet of SUPP heifers. Supplementation treatments began around the start of the breeding season, which included artificial insemination (AI) and natural service breeding. Data were analyzed using the GLIMMIX procedures of SAS with the individual heifer as the experimental unit. Average daily gain was improved ($P = 0.01$) by omega-3-based supplementation with little impact on dry matter intake or feed efficiency. Neither AI nor total pregnancy rates were influenced ($P \geq 0.70$) by supplementation. Data suggest that omega-3 supplementation in forage diets for developing replacement heifers at various levels and durations may influence BW gain with little effect on reproduction in well-developed heifers.

Introduction

Sufficient growth and development before first service are critical to ensure replacement heifers have active estrous cycles and conceive early in their first breeding season. Nutrition during the post-weaning period through the start of the breeding season influences reproduction through direct effects on growth and reproductive development. In many Midwest production systems, it is typical for heifers to be developed before the breeding season on diets consisting of stored forages, grain processing by-products, and concentrates, which are naturally low in omega-3 fatty acids. Such fatty acids have been shown to have potential positive effects on reproduction, yet finding readily available

sources to incorporate into diets is often challenging. Likewise, strategic protein or energy supplementation around the start of the breeding season has been evaluated as a method to improve conception rates; however, little work has been done focusing on this approach with sources of omega-3 fatty acids. Our objective was to evaluate the strategic, short-term supplementation of a commercial source of omega-3 fatty acids in developing replacement heifers at the start of breeding on growth and reproduction.

Experimental Procedures

This two-year study was conducted in 2024 and 2025 at the Kansas State University Precision Feed Intake facility with spring-born heifers (Angus, Simmental, or Hereford) originating from the Purebred Beef Unit herd. Trial duration was from April 9 to June 5 (56 days) and April 4 to June 10 (68 days) in 2024 and 2025, respectively. Heifers (n = 85 total) were weaned from their dams in September of the previous year, managed in open, earthen dry lot pens, and fed a forage-based diet designed to achieve an average daily gain (ADG) of approximately 1.5 lb. At trial initiation, heifers were weighed over two consecutive days, with weights averaged to determine initial body weight (BW). In a completely randomized design, heifers were assigned based on BW and age to one of two treatments: non-supplemented control (NOSUPP) or supplemented (SUPP) with an extruded flaxseed and algae-based supplement designed to provide omega-3 fatty acids (Better Fed Foods/NBO3, Manhattan, KS). On a dry matter basis, heifers in 2024 received 0.48 lb/head/day of the omega-3 supplement, and heifers in 2025 received 0.72 lb/head/day.

Average age across both years at trial initiation was 414 ± 25 days, and 415 ± 26 days for SUPP and NOSUPP heifers, respectively. Before collecting initial BW at the start of the trial, heifers were fitted with electronic identification ear tags and were trained to consume feed from Insentec precision intake management bunks (Hokofarm, Emmeloord, the Netherlands). Upon trial initiation in both years, all heifers were placed in a single pen and managed as a common group throughout the study. Heifers could only consume feed from bunks to which their corresponding treatment groups were assigned. Within a year, all heifers were fed a common diet that was mixed and delivered daily, and heifers assigned to the SUPP treatment received the omega-3 fatty acid-based supplement mixed into the base ration. Diet ingredient compositions are presented in Table 1. In year two, more than one base diet was fed due to ingredient availability and logistical constraints.

During the two-year study, the SUPP treatment consisted of 46 heifers, 27 in year one and 19 in year two. The NOSUPP treatment consisted of 39 heifers, 26 in year one and 13 in year two. In both years, estrus was synchronized using the Select Synch + controlled internal drug release (CIDR) and timed artificial insemination (AI) protocol. All heifers in both years were inseminated by a single technician if either displaying estrus within the first three days following administration of prostaglandin and removal of the CIDR or no later than 84 hours afterward. In year one, omega-3 fatty acid supplementation started five days following the date of the first timed AI and continued for 10 days. In year two, omega-3 supplementation began 10 days before the start of the first timed AI and continued throughout the entire trial period. In both years, heifers that failed to conceive from the first AI service then received a second AI service upon display of estrus. Following the second AI service, heifers were exposed to Angus sires for natural service for a minimum of 45 days. Upon completion of the feeding period and collection of ending weights, heifers were transported to nearby

native Flint Hills pastures for summer grazing. Pregnancy status was determined via rectal palpation by a single trained technician.

Data were analyzed using the GLIMMIX procedure of SAS (SAS, Inc., Cary, NC) with the individual heifer as the experimental unit. The model included the fixed effect of omega-3-based supplementation, with year and breed considered as random effects. Reproduction data were evaluated as a binomial response measurement. Least square means were declared significant at a *P*-value ≤ 0.05, with tendencies declared at a *P*-value > 0.05 and ≤ 0.10.

Results and Discussion

Heifer performance and reproduction data are reported in Table 2. The age between NOSUPP (415 days) and SUPP (414 days) treatments was similar as intended. Likewise, initial BW was not different ($P = 0.44$) between NOSUPP (873 lb) and SUPP (853 lb) heifers by design. Average daily gain was greater ($P = 0.01$) in SUPP heifers (2.31 lb per day) than in NOSUPP heifers (1.92 lb per day), likely due to protein and energy being supplied from the omega-3 based supplement in addition to that provided in the basal diet. As a result, total BW gain was also increased ($P = 0.01$) in SUPP heifers (146 lb) relative to non-supplemented females (121 lb). Although ADG and total gain were increased, ending BW was not different ($P = 0.76$) between treatments, likely due to weight variability across treatment groups at the start of the trial, which resulted in a slight numerical difference in initial BW between SUPP and NOSUPP heifers. Dry matter intake, which accounted for the supplement, was not different ($P = 0.25$) between treatments. Concurrently, feed efficiency was not impacted ($P = 0.24$) by supplementation at 0.105 and 0.114 lb for NOSUPP and SUPP, respectively. First-service AI conception rates were not influenced by supplementation ($P = 0.94$), and overall pregnancy rates were also not different ($P = 0.70$) between treatments at 85.7% and 88.6% for NOSUPP and SUPP, respectively.

The improvement in ADG in response to supplementation is consistent with that typically observed when growing cattle consuming forage-based diets are supplied with additional protein and energy, with the magnitude of the increase related to many factors such as basal diet protein, fat, and digestible fiber content. Results from this dataset suggest that omega-3 supplementation of this form may positively impact performance across a range of inclusion levels and feeding durations. While these data suggest dietary inclusion has minimal impact on conception rates under the conditions of this study, effects of omega-3 supplementation on reproduction in beef heifers warrant further exploration as responses are likely due to numerous factors, including overall plane of nutrition, diet protein and energy levels, population size evaluated, and puberty attainment prior to breeding.

Implications

Data indicate that relatively short-term supplementation of an omega-3 based fatty acid supplement around the start of the breeding season may improve growth rates of replacement heifers fed forage-based diets. In heifers that are well-developed before the start of the breeding season, reproductive responses to supplementation are likely more variable.

Acknowledgments

The authors extend appreciation to Shane Werk, former Purebred Beef Unit Manager, and all student employees of the unit for their assistance with daily care and management of the cattle represented in this report, as well as data collection. Appreciation is also extended to Better Fed Foods/NBO3, Manhattan, KS, for their support of this research.

Table 1. Ingredient composition of diets fed to growing replacement heifers by year[1]

	Year 1	Year 2		
Ingredient, %	**Diet 1**	**Diet 1[2]**	**Diet 2[3]**	**Diet 3[4]**
Grass hay	31.3	37.3	37.2	---
Corn silage	21.7	23.9	23.9	73.1
Sweet Bran	25.7	---	---	---
DDGS[5]	---	---	---	24.3
Wheat middlings	---	---	20.0	---
Corn germ meal	---	19.8	---	---
Dry rolled corn	13.6	16.4	16.3	---
Supplement	7.7	2.6	2.6	2.6
Diet dry matter, %	63.4	63.3	63.5	39.8
Omega-3 supplement, lb[6]	0.48	---	0.72	0.72

[1] All values on a 100% dry matter basis, except for diet dry matter.
[2] Diet 1 fed from 4/04/25 to 5/11/25.
[3] Diet 2 fed from 5/12/25 to 5/23/25.
[4] Diet 3 fed from 5/24/25 to 6/10/25.
[5] Corn dried distillers grains with solubles.
[6] Amounts included on a per head per day basis.

Table 2. Performance and reproduction of heifers by supplementation treatment

	Treatment			
Item	**NOSUPP[1]**	**SUPP[2]**	**SEM[3]**	***P*-value**
Initial age, days	415	414	---	---
Initial body weight, lb	873	853	24.3	0.44
Ending body weight, lb	988	997	27.6	0.76
Total body weight gain, lb	121	146	9.8	0.01
Average daily gain, lb	1.92	2.31	0.15	0.01
Dry matter intake, lb per day	19.2	20.1	0.78	0.25
Gain:feed, lb	0.105	0.114	0.008	0.24
Artificial insemination pregnancy, %[4]	60.0	59.0	0.11	0.94
Total pregnancy, %[5]	85.7	88.6	0.08	0.70

[1] NOSUPP = heifers not supplemented with an omega-3 based fatty acid supplement.
[2] SUPP= heifers supplemented with an omega-3 based fatty acid supplement.
[3] SEM = standard error of the mean.
[4] Heifers conceiving to AI on first service divided by the total within each treatment.
[5] Heifers conceiving to either AI or natural service divided by the total within each treatment.