

Project Title:	Impact of Feeding 2,500, 50,000 or 100,000 International Units of Vitamin D ₃ Daily on Feedlot Performance and Cooked Beef Tenderness
Principle Investigator(s):	Brad Morgan
Institution(s):	Oklahoma State University
Completion Date:	July 2004

Background

Over the last decade, researchers have examined the potential of supplementing vitamin D₃ during the feeding phase as a method to improve tenderness of cooked beef. It is thought that increased levels of dietary vitamin D₃ immediately prior to harvest will result in increased calcium concentrations in postmortem muscle. Elevated calcium levels result in the weakening of myofibrillar structures, thus increasing the tenderness of beef muscles. Previous research has shown that supplementing high doses of vitamin D (5 to 8 million international units per animal per day) for five to 10 days prior to harvest has improved Warner-Bratzler shear force of cooked beef cuts, however other studies have not shown the same results. There are potential negative effects in including vitamin D as part of a feeding ration, including decreased live animal performance such as lower dry matter intake resulting in decreased growth performance and reduced hot carcass weights. There are also potential toxicological effects that may occur during high vitamin D supplementation.

In this project, researchers sought to develop a method that would lower the effective dose of vitamin D to eliminate any negative association with performance or toxicological effects while still achieving increased tenderness. The researchers thought that a low-dose, long-term feeding method was more cost effective and would have greater application within commercial feeding systems.

Methodology

Yearling steers (n = 180) were received at Oklahoma State University facilities and were randomly assigned to three experimental groups. The groups received one of three dietary treatments:

- 1) 2,500 international units of vitamin D (control group)
- 2) 50,000 international units of vitamin D
- 3) 100,000 international units of vitamin D

All of the steers underwent the same preventative health treatments, including vaccination for respiratory and clostridial diseases (Titanium 5 L5 and Vision 7 with Spur), anthelmintic for both internal and external parasites, and implanted with a 4-milligram estradiol growth promotant. Steers were reimplanted after 70 days on feed. Weights were recorded on the initial day, as well as day 35, 70, 105, 131 and 176. Blood samples were collected from representative sample of the steers.

Steers received a four-stage diet (55, 70, 80 and 87 percent dry matter of concentrate for eight, six, seven and six days, respectively) and a final finishing diet consisting of 80.7 percent rolled corn, 8 percent ground alfalfa hay, 3 percent and 8.3 percent pelleted vitamin D supplement.

Two-thirds of the steers were harvested after 146 days on feed and the remaining steers were harvested after 181 days of feeding the experimental ration. After a 30-hour chill period, hot carcass weight, ribeye area, fat thickness, kidney-pelvic-heat (KPH) fat, marbling score

and U.S. Department of Agriculture (USDA) grades for yield and quality were recorded. The *longissimus thoracis* was collected from each carcass and objective tenderness values were measured using Warner Bratzler shear force. Samples were also given to a trained sensory panel to evaluate overall tenderness, juiciness, cooked beef flavor, off flavor and overall acceptance. of sensory attributes. A representative sample of kidney and muscle tissue samples were collected to determine vitamin D and vitamin D metabolite concentrations.

Findings

Feedlot performance did not differ among the three different treatments. The reduced dose of vitamin D was successful in eliminating any negative effects on growth performance that has been reported in previous research. Yield grade and quality grade were not influenced by level of supplementation.

Vitamin D supplementation at 50,000 and 100,000 international units per head per day significantly increased plasma concentrations of vitamin D compared to the control group. Vitamin D plasma concentrations were 5.8 times greater in the animals receiving the 100,000 international units of vitamin D compared to the control group. As the level of vitamin D supplementation increased; plasma calcium concentration also increased.

Vitamin D supplementation resulted in more tender steaks following shorter postmortem aging times (i.e., less than 14 days) when compared to the control steaks. Cattle supplemented with 100,000 international units of vitamin D daily for the entire duration of the finishing period generated *longissimus thoracis* steaks that did not respond to postmortem aging. Rather, postmortem aging was hastened for carcasses in the 100,000 international unit treatment group, in that they displayed similar shear force values across all postmortem aging periods.

Sensory panelists rated *longissimus thoracis* steaks from steers supplemented with vitamin D as being more tender than the control steaks. There were no significant differences in sensory evaluations of steaks from steers supplemented with 50,000 or 100,000 international units of vitamin D per head per day. Juiciness, cooked beef flavor and off flavor were not significantly affected by dietary treatment of vitamin D.

Implications

Based on this study, lower doses of vitamin D supplementation to feedlot cattle were shown to have positive effects on beef tenderness. This research demonstrates that supplementing feedlot cattle with vitamin D may be an effective means to improve consumers' eating experiences by creating a more consistently tender product.