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Nutrient restriction does not affect implant efficacy

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Abstract

Anabolic implants in finishing beef cattle offer significant return on investment. Anabolic implants improve average daily gain feed efficiency in pasture and feedlot cattle. One way growth-promoting implants stimulate growth is through increasing production of insulin-like growth factor 1. This hormone causes muscle cells to increase their uptake of glucose and amino acids from the bloodstream. Plasma urea nitrogen is a simple measure of the protein nutritional status of animals. If lean growth is stimulated, more feed protein is utilized and retained as body protein, reducing the amount of circulating plasma urea nitrogen. If an animal is stressed and is not growing, more of the feed protein is broken down, processed, and excreted as urea nitrogen.

Keywords

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Nutrient Restriction Does Not Affect Implant Efficacy

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Introduction

Anabolic implants in finishing beef cattle offer significant return on investment. Anabolic implants improve average daily gain feed efficiency in pasture and feedlot cattle. One way growth-promoting implants stimulate growth is through increasing production of insulin-like growth factor 1. This hormone causes muscle cells to increase their uptake of glucose and amino acids from the bloodstream.

Plasma urea nitrogen is a simple measure of the protein nutritional status of animals. If lean growth is stimulated, more feed protein is utilized and retained as body protein, reducing the amount of circulating plasma urea nitrogen. If an animal is stressed and is not growing, more of the feed protein is broken down, processed, and excreted as urea nitrogen.

Cattle usually are processed and implanted upon arrival at most feed yards. At that time, many calves are stressed by transport, changes in environment, and changes in feeding routine. These cattle have lower than normal feed intakes for up to 3 weeks after arrival at the feedlot and can subsequently become immunocompromised. Stress or infection can lead to weight loss and increased muscle protein breakdown.

The response of the body to implants is to stimulate nutrient uptake by tissues, which is normally measured as increased insulin-like growth factor 1 and decreased plasma urea nitrogen in healthy, non-stressed cattle. However, if nutrients are not in excess, it is not known what effect the external growth stimulation by implants may have on the body. Given the anabolic nature of implants, it is conceivable that implants may be counter-productive when the nutrient requirements of the animal are not met. The objective of our study was to evaluate the impact that anabolic implants have on animals that are in a restricted nutritional state.

Experimental Procedure

Sixteen 650-lb crossbred beef steers were used in this study. All cattle were weighed and processed at receiving. The steers were fed a common, pelleted, wheat middlings-based growing diet (15.3% crude protein; NEg 0.39 Mcal/lb) for the duration of the study. The study was designed as a 2 × 2 factorial arrangement of treatments. Four calves each were randomly assigned to: (1) implant (Revalor XS; Intervet/Schering-Plough, Inc., Millsboro, DE) + 2x maintenance intake, (2) implant (Revalor XS) + 1x maintenance intake, (3) no implant + 2x maintenance intake, or (4) no implant + 1x maintenance intake. Cattle were fed for 28 days. Blood samples were drawn on days 0, 14, and 28 for analysis of plasma urea nitrogen and insulin-like growth factor 1.

Results and Discussion

No diet x implant interactions arose in our analysis of calf body weights ($P=0.23$). Calves that were fed at 2x maintenance had greater ($P<0.01$) body weights at the end of the study than the calves fed at 1x maintenance. Diet also affected average daily gain ($P<0.05$; 3.63 vs. 0.09 lb/day for 2x maintenance vs. 1x maintenance, respectively). By design the restricted cattle were fed only to maintain their weight, which was accomplished. Implant status did not affect average daily gain ($P=0.45$).

Plasma urea nitrogen decreased ($P=0.01$) in the cattle fed only to maintain their weight compared to those fed at 2x maintenance (Figure 1), which is as expected because the restriction was designed to meet only maintenance protein and energy requirements. Therefore, we would not expect a great deal of circulating nitrogen. However, an interaction occurred between diet and implant status in plasma urea nitrogen ($P=0.09$) on day 28. Plasma urea nitrogen was greater ($P<0.05$) in full-fed, implanted calves than in restricted, non-implanted calves, with other treatments being intermediate and not different from either.

No interaction occurred between diet and implant status on day 28 in insulin-like growth factor 1 ($P=0.33$), and plasma insulin-like growth factor 1 levels in calves fed only to maintain body weight were lower ($P<0.05$) than in calves fed at 2x maintenance (Figure 2). This is as expected because previous research has demonstrated that when healthy calves are restricted in nutrient intake, insulin-like growth factor 1 decreases[1]. In contrast to previous research, however, plasma insulin-like growth factor 1 was not affected by implant status ($P=0.41$), which agrees with the lack of gain response to implants in the present study. Normally, implanted calves have elevated insulin-like growth factor 1 levels compared to non-implanted calves, accompanied by greater daily gain. The hypothesis was that the implants would have caused increased insulin-like growth factor 1 in nonrestricted-fed calves but not in the restricted-fed calves; however, this was not the case.

Implications

As expected, nutrient intake affected growth rate, plasma urea nitrogen, and insulin-like growth factor 1, but implant status did not substantially alter the effects of nutrient restriction on these measures. Additional work will assess whether other circulating factors could influence muscle growth in response to implants at different levels of nutrition.

[1] Reinhardt, C.D. 1991. Metabolic indices for growth: Endocrine profile of steers on various nutritional and growth promotional regimes. Texas A&M University, College Station, TX.

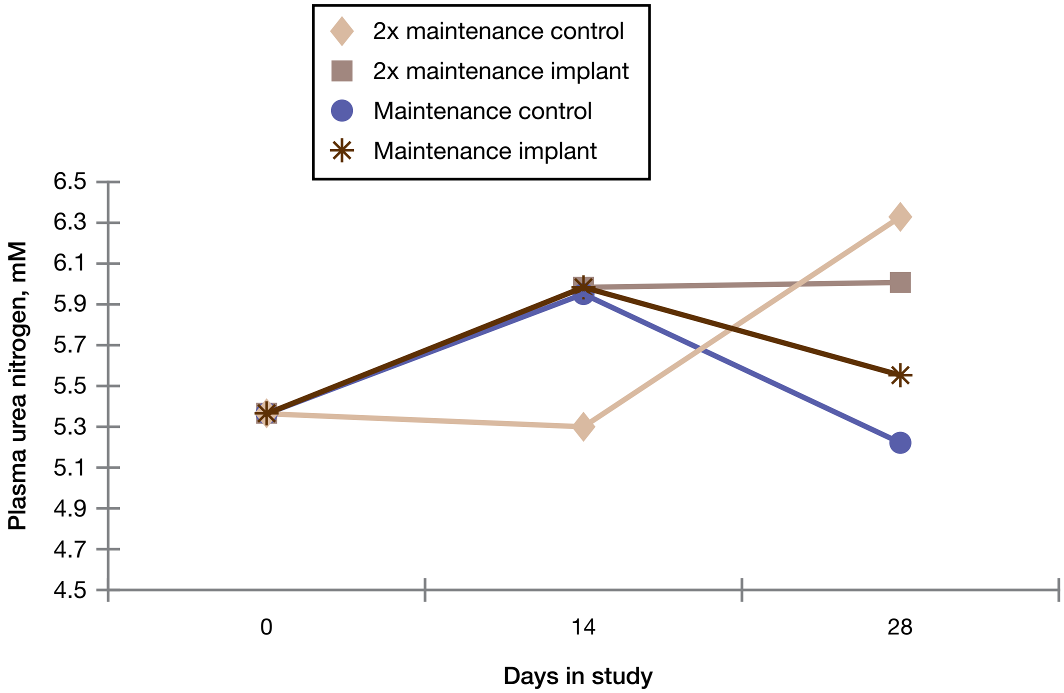

Figure 1. Plasma urea nitrogen affected by level of feed intake and implant status (diet P=0.01; implant P=0.54; diet × implant P=0.09).

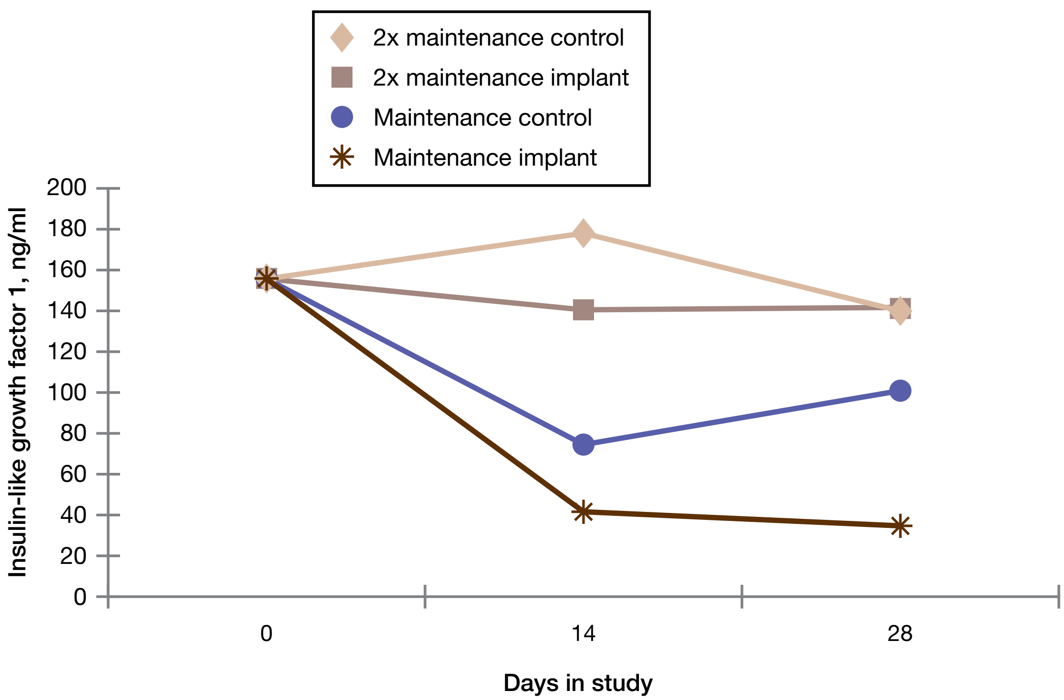

Figure 2. Plasma insulin-like growth factor 1 as affected by level of feed intake and implant status (diet P<0.01; implant P=0.41; diet × implant P=0.33).