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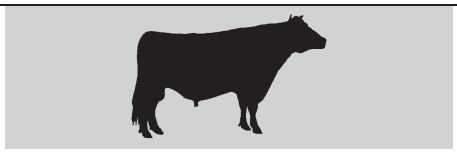

Effects of continuous and step-up ractopamine hydrochloride supplementation protocols on feeding performance and carcass characteristics of finishing steers[1]

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ABSTRACT

The objectives of this experiment were to evaluate the effects of continuous (CNT) and step-up (STP) ractopamine hydrochloride (RH) supplementation protocols during the last 42 d of the finishing period on feeding performance and carcass characteristics of market steers. Thirty-six Angus-Simmental cross steers (510 ± 4.99 kg initial BW) were blocked by BW and randomly assigned to 1 of 3 isocaloric, isonitrogenous treatments containing 0 (CON) or 200 (CNT) mg of RH from d 0 to 42 or daily supplementation of 100 mg of RH from d 0 to 21, no RH from d 21 to 28, and daily supplementation of 300 mg of RH from d 28 to 42 (STP). Steers were fed for ad libitum intake, BW were measured at 14-d intervals, and final BW were measured on d 41 and 42 before slaughter to monitor feedlot performance. Carcass characteristics were collected following a 24-h chill. There were no differences across treatments for initial BW or DMI throughout the feeding period ($P \geq 0.26$). Likewise, ADG did not differ ($P \geq 0.20$), and there were no changes in total BW gain ($P = 0.52$) or G:F ($P = 0.36$) due to dietary treatment. The lack of performance differences was reflected in several carcass measurements often affected by BW gain with no differences across treatments for HCW ($P = 0.31$), DP ($P = 0.80$), 12th-rib fat thickness ($P = 0.35$), LM area ($P = 0.19$), percentage of KPH ($P = 0.97$), and YG ($P = 0.38$). However, CON had greater marbling scores ($P = 0.04$) than did CNT, with STP being intermediate to both treatments. This last effect likely contributed to the trend in QG differences ($P = 0.08$) between CON and CNT, with STP again being intermediate. Feeding performance was not altered because of RH supplementation at either a constant level or a step-up protocol over a period of 42 d. Carcass quality was not improved and continuous RH administration had a negative effect on marbling and potentially final QG of beef steers.

Key words: beta-agonist, continuous, ractopamine, steer, step-up

INTRODUCTION

Production costs and feed efficiency are factors often scrutinized by beef producers. In the current economic climate, proven feeding strategies that benefit these 2 variables are crucial to feedlot operations. Supplementing livestock diets with a β-adrenergic agonist, such as ractopamine hydrochloride (**RH**), has been shown to benefit feed efficiency by partitioning

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feedstuffs toward protein synthesis rather than fat accretion (Baker et al., 1984; Ricks et al., 1984; Watkins et al., 1990). Marketed for beef cattle by Elanco Animal Health (Greenfield, IN), Optaflexx is approved for feeding during the last 28 to 42 d before slaughter at concentrations ranging from 70 to 430 mg/animal daily.

The addition of RH to finishing diets has increased ADG and improved feed efficiency, the later measured by G:F (Anderson et al., 1989; Carroll et al., 1990; Preston et al., 1990). Delivery of RH at a rate of 200 mg/animal daily for 35 d has been reported as the optimal combination of continuous RH supplementation to improve ADG and G:F in finishing steers (Abney et al., 2007), and a similar effect has been reported at d 22 of RH supplementation in swine diets (Williams et al., 1994). These dose-duration thresholds may be due to continuous RH feeding, which causes up regulation of β-adrenergic receptor kinase, an inactivator of β-adrenergic receptors (**β-AR**; Mersmann, 1998). Although recent chronic stimulation studies on the effects of RH on β-AR mRNA abundance were inconclusive regarding β-AR desensitization (Sissom et al., 2007; Walker et al., 2007; Winterholler et al., 2007, 2008), providing a brief interval with no RH supplementation may improve growth responses over extended periods of continuous RH feeding by allowing receptor resensitization via down regulation of β-adrenergic receptor kinase.

There is limited literature on the effects of feeding RH intermittently. Therefore, this experiment was designed to evaluate the effects of continuous and intermittent or step-up RH feeding on growth and carcass characteristics in beef steers.

MATERIALS AND METHODS

Animals and Treatments

The Purdue Animal Care and Use Committee approved all procedures involving the animals used in this experiment. Thirty-six Angus-Simmental cross steers (510 ± 5.0 kg initial BW) were used in this experiment. All steers were obtained from the Purdue University Southern Indiana Agricultural Center and were shipped to the Purdue University Animal Sciences Research and Education Center. Upon arrival, all steers were initially fed the same grower diet (60 d) and transitioned to the finishing diet (Table 1) used in the experiment. Steers were housed individually in a barn with concrete slatted floors in 1.4 × 3.4 m pens with free access to an automated watering system. Initial steer BW was the average of BW measured on d −1 and 0. Steers (n = 36; 12 per pen) were blocked by initial BW and randomly assigned to 1 of 3 treatments for 42 d immediately before slaughter: 1) control (no dietary RH; **CON**); 2) daily supplementation of 200 mg of RH from d 0 to 42 (200 mg; **CNT**); and 3) daily supplementation of 100 mg of RH from d 0 to 21, no RH from d 22 to 28, and daily supplementation of 300 mg of RH from d 29 to 42 (**STP**). Concentration of RH was calculated as milligrams per steer per pen and mixed directly into the finishing diet before daily delivery. Bunks were evaluated daily at 0600 h to determine the amount of feed to be offered, and steers were fed ad libitum at 0700 h daily.

Performance and Carcass Characteristics Data Collection

Body weights were measured at 14-d intervals, and final BW was measured on 2 consecutive days (d 41 and 42) before slaughter to monitor feedlot performance. Steers were fed in quantities sufficient to ensure ad libitum DMI, and G:F was calculated from BW gain divided by DMI. Steers were slaughtered at a commercial abattoir. Hot carcass weights were measured postexsanguination. Following a 24-h chill, trained personnel collected DP, fat thickness over the 12th rib, LM area, KPH, preliminary YG, marbling score, and QG. Final YG were determined according to the formula established by Aberle et al. (2001).

Statistical Analysis

Growth performance and carcass characteristics were analyzed using the MIXED procedure (SAS Institute Inc., Cary, NC) for a randomized complete block design, and pen was used as the experimental unit. Least squares means were separated using the pdiff procedure of SAS and were considered significant when the P-value was ≤ 0.05, with a P-value ≤ 0.10 considered to be a tendency approaching significance.

RESULTS AND DISCUSSION

Growth Performance

Production variables such as ADG, DMI, and G:F have a significant effect on the financial viability of cattle feeding operations. Each of these variables has repeatedly been improved through RH supplementation in cattle and swine feeding trials (Anderson et al., 1989; Carroll et al., 1990; Preston et al., 1990; Avendaño-Reyes et al., 2006; Abney et al., 2007). In beef cattle, several studies have shown that the optimal feeding threshold of RH supplementation is 33 to 35 d at a level of 200 mg/animal daily (Avendaño-Reyes et al., 2006; Abney et al., 2007). The present experiment was designed to determine if an intermittent or step-up RH feeding method would prevent a reduction in finishing performance the final 7 d of a 42-d finishing period as has previously been reported in continuous-RH inclusion trials (Abney et al., 2007). The data from this experiment confirm that growth performance will not be improved when RH is fed for a 42-d feeding period at levels exceeding 100 mg/d per steer. At experiment initiation, BW were similar ($P = 0.53$) among treatments (505.3, 513.3, 510.0 ± 4.99; CON, CNT, STP, respectively; Table 2), and BW did not differ at d 14 ($P = 0.48$), d 28 ($P = 0.26$), or at the conclusion of the feeding period ($P = 0.41$). Dry matter intake was not affected by dietary treatment ($P = 0.61$), and ADG were also similar among treatments throughout the