CAMELINA MEAL SUPPLEMENTATION TO BEEF CATTLE: III. EFFECTS ON ACUTE-PHASE AND THYROID RESPONSES

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ABSTRACT: Fourteen halter-trained Angus steers were ranked by initial BW (average 191 ± 2.1 kg), and assigned (d 0) to receive supplements containing (as-fed basis): 1) 84 % corn, 14 % soybean meal, and 2 % mineral mix (CO); and 2) 70 % corn, 28 % camelina meal, and 2 % mineral mix (CAM). Treatments were offered individually, at a daily rate of 1.65 and 1.52 kg of DM/steer for CO and CAM, respectively. Alfalfa-grass hay was offered ad libitum during the study (d 0 to 36). On d 24, steers were fitted with a jugular catheter and were infused (i.v.) on d 25 with 0.5 µg of bovine corticotropin-releasing hormone (CRH)/kg of BW. Blood samples were collected hourly from -2 to 0 h and 4 to 8 h, and every 30 min from 0 to 4 h relative to treatment infusion (0 h). Blood samples were also collected via jugular venipuncture every 6 h from 12 to 72 h, and every 24 h from 96 to 168 h. All samples were analyzed for plasma concentrations of cortisol, ceruloplasmin, and haptoglobin. No treatment effects were detected (P = 0.28) for cortisol concentrations, which peaked, respectively, at 0.5 h relative to CRH infusion (time effect; P < 0.01). Ceruloplasmin concentrations were greater for CO vs. CAM steers at 6, 18, 42, 120, 144, and 168 h relative to CRH infusion (treatment x time interaction, P < 0.01). Mean haptoglobin concentrations tended to be greater (P = 0.10) for CO vs. CAM steers (1.73 vs. 1.54 absorbance @ 450 nm x 100, respectively). On d 34, steers were again fitted with a jugular catheter and were infused (i.v.) on d 35 with 0.33 µg of bovine thyrotropin-releasing hormone (TRH)/kg of BW. Blood samples were collected hourly from -2 to 0 h and 4 to 8 h, every 30 min from 0 to 4 h, and every 4 h from 8 to 24 h relative to treatment infusion (h 0) for determination of serum T3 and T4. No treatment effects were detected for T3 (P = 0.58) and T4 (P = 0.54) concentrations, which peaked, respectively, at 3 and 5 h relative to TRH infusion in both treatments. In conclusion, camelina meal supplementation did not affect thyroid gland function following a TRH challenge, but alleviated the acute-phase protein response following a CRH challenge in beef steers.

Key Words: Acute-phase, camelina meal, thyroid

Materials and Methods

The experiment was conducted in accordance with an approved Oregon State University Animal Care and Use Protocol. Fourteen weaned Angus steers were utilized in these studies. All steers were exposed daily (d -60 to d 0) to halter-training techniques to become acclimated to human interaction; thus preventing confounding effects between human handling, weaning and hormone challenges measured herein (Cooke et al., 2009). Steers were ranked by initial BW (average 191 ± 2.1 kg), and assigned on d 0 to receive 1 of 2 treatments: 1) supplement containing (as-fed basis) 84 % corn, 14 % soybean meal, and 2 % mineral mix (CO); and 2) supplement containing (as-fed basis) 70 % corn, 28 % camelina meal, and 2 % mineral mix (CAM). Treatment intakes were formulated to be iso-caloric and iso-nitrogenous, and offered individually at a daily rate of 1.65 and 1.52 kg of DM/steer for CO and CAM.
respectively. Alfalfa-grass hay was offered ad libitum during the study (d 0 to 36).

On d 24 and 34 of the study, steers were fitted with a jugular catheter according to procedures described by Merrill et al. (2007), and were infused (i.v.) on d 25 and 35 with 0.5 μg of bovine CRH/kg of BW (Exp. 1) and 0.33 μg of bovine TRH/kg of BW (Exp. 2), respectively. In Exp. 1, blood samples were collected hourly from −2 to 0 h and 4 to 8 h, and every 30 min from 0 to 4 h relative to treatment infusion (0 h) via jugular catheters. Blood samples were also collected via jugular venipuncture every 6 h from 12 to 72 h, and every 24 h from 96 to 168 h. All samples were analyzed for plasma concentrations of cortisol, ceruloplasmin, and haptoglobin. In Exp. 2, blood samples were collected via jugular catheters hourly from −2 to 0 h and 4 to 8 h, every 30 min from 0 to 4 h, and every 4 h from 8 to 24 h relative to treatment infusion (h 0) for determination of serum T₃ and T₄. Blood samples were harvested for plasma and serum, and stored at −80°C until assayed for plasma concentrations of cortisol Endocrine Technologies Inc., Newark, CA), ceruloplasmin (Demetriou et al., 1974) and haptoglobin (Makimura and Suzuki, 1982), and serum concentrations of T₃ and T₄ (Endocrine Technologies Inc.).

Data from Exp. 1 and 2 were analyzed using the PROC MIXED procedure of SAS (SAS Inst., Inc., Cary, NC) and Satterthwaite approximation to determine the denominator df for the tests of fixed effects. The model statement contained the effects of treatment, time, and the interaction. Data were analyzed using steer(treatment) as the random variable. The specified term for the repeated statement was time and the covariance structure utilized was autoregressive, which provided the best fit for these analyses according to the Akaike information criterion. Results are reported as least square means and separated using LSD. Significance was set at P ≤ 0.05, and tendencies reported according to treatment effects, or according to the highest-order interaction detected.

Results and Discussion

In Exp. 1, no treatment (P = 0.28) effects were observed for cortisol concentrations (Figure 1). Steers receiving CAM tended (P = 0.10) to have reduced mean haptoglobin concentrations compared to CO steers (1.54 vs. 1.73 absorbance @ 450 nm × 100, respectively; Figure 2). A treatment x time interaction (P < 0.001) was detected for ceruloplasmin concentrations, because CAM steers had reduced ceruloplasmin concentrations compared with CO steers at 6, 18, 42, 120, 144, and 168 h relative to CRH infusion (Figure 2). These results suggest that CAM and CO steers experienced a similar increase in plasma cortisol concentrations (Cooke and Bohnert, 2011), but camelina meal supplementation alleviated the acute-phase response stimulated by the CRH challenge. Similarly, previous research from our group reported that PUFA supplementation alleviated the acute-phase response in beef steers following transport and feedlot entry (Cooke et al., 2010).

![Figure 1](image1.png)

**Figure 1.** Plasma cortisol concentrations of steers supplemented (CAM) or not (CO) with camelina meal and receiving 0.5 μg of bovine corticotropin-releasing hormone (CRH)/kg of BW at h 0. Steers receiving CAM tended (P = 0.28) or treatment x time interaction (P = 0.09) were detected.

![Figure 2](image2.png)

**Figure 2.** Plasma haptoglobin (panel A; absorbance at 450 nm × 100) and ceruloplasmin (panel B; mg/dL) concentrations of steers supplemented (CAM) or not (CO) with camelina meal and receiving 0.5 μg of bovine corticotropin-releasing hormone (CRH)/kg of BW at h 0. Steers receiving CAM tended (P = 0.10) to have reduced mean haptoglobin concentrations compared to CO steers. A treatment x time interaction was detected for ceruloplasmin concentrations (treatment comparison within time: * P < 0.05).

In Exp. 2, no treatment effects were detected for serum T₃ (P = 0.58) and T₄ (P = 0.55) concentrations, which peaked, respectively, at 3 and 5 h relative to TRH infusion in both treatments (Figure 3). Moriel et al. (2010) reported that heifers fed camelina meal had greater T₃ concentrations compared to cohorts fed a corn-soybean meal diet, whereas no differences were detected for serum T₄ concentrations. Therefore, camelina meal does not impair thyroid gland function in beef cattle when supplemented at the rates utilized herein and by Moriel et al. (2010).
Figure 3. Plasma concentrations of T₃ (panel A) and T₄ (panel B) of steers supplemented (CAM) or not (CO) with camelina meal and receiving 0.33 μg of bovine thyrotropin-releasing hormone (TRH)/kg of BW at h 0. No treatment effects were detected (P > 0.55).

Implications

Camelina meal supplementation did not impair thyroid gland function following a TRH challenge, but alleviated the acute-phase protein response stimulated by CRH challenge in beef steers.

Literature Cited


