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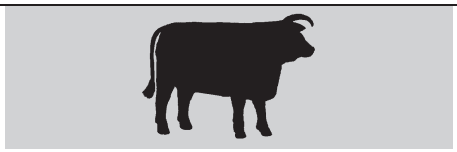

Effects of replacing ground corn with wet brewers grains on growth performance and concentrations of liver trace minerals and plasma fatty acids of preconditioning beef heifers fed medium-quality fescue hay

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ABSTRACT

Our goal was to evaluate growth performance and concentrations of liver trace minerals and plasma fatty acids of beef heifers supplemented with wet brewers grains (WBG) replacing ground corn (CN). On d 0, 27 Angus beef heifers (218 ± 3 kg; 225 ± 23 d of age) were randomly assigned into 1 of 9 drylot pens (3 heifers per pen). Treatments were randomly assigned to pens (3 pens per treatment) and consisted of heifers receiving a 42-d period of daily supplementation with 100% CN, 100% WBG, or a 50:50 mixture of CN and WBG (CNWBG). Supplements provided equal daily supplemental TDN (0.7% of BW). Average daily gain from d 0 to 42 was similar (P = 0.65) between CNWBG and WBG, and tended (P ≤ 0.08) to be least for CN. Hay and total DMI were less (P ≤ 0.05) for heifers fed WBG versus CN and CNWBG supplements in 3 of 6 wk. Thus, G:F was similar (P = 0.63) between CNWBG and WBG but least (P ≤ 0.004) for CN heifers. Intake of S, Cu, Se, and Zn increased (P ≤ 0.05) as WBG replaced corn. Yet, liver concentrations of trace minerals did not differ among treatments (P ≥ 0.16). Intake of supplemental fat and total fat increased (P ≤ 0.02) as WBG replaced corn. Plasma 18:1 trans-11 and 18:1 cis-9 concentrations were less for WBG versus CN and CNWNG heifers (P ≤ 0.04). Therefore, replacing ground corn with WBG enhanced growth performance but not concentrations of plasma fatty acids and liver trace mineral in beef heifers.

Key words: beef heifer, corn, preconditioning, tall fescue, wet brewers grain

INTRODUCTION

Brewers grains are by-products of barley brewing that can be marketed as wet (**WBG**) or dried brewers grains. On a DM basis, WBG has intermediate TDN concentrations (72%) and elevated CP (29%) and crude fat (6.5 to 11%; NRC, 2000) concentrations and is often less expensive than traditional energy sources, such as corn, making WBG an attractive energy and protein source for ruminants. In fact, WBG has been successfully included as alternative feed sources for feedlot beef cattle (Preston et al., 1973; Ojowi et al., 1997). Yet, we are unaware of studies evaluating WBG supplementation to growing calves fed forage-based diets. For instance, preconditioning beef calves require energy-based supplementation to enhance growth performance, but this type of cattle may still experi-

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ence CP deficiency if forages offered are less than 14% CP. Hence, supplementation with feed sources with CP concentrations greater than corn (i.e., WBG) might enhance the growth performance of beef calves fed medium-quality forages.

Because of the removal of sugar and starch after malting and mashing processes, WBG contains greater concentrations of minerals than the foundation grains (Westendorf and Wohlt, 2002). Dietary concentrations of Cu, Fe, Mn, Mo, and Zn linearly increased as WBG was gradually added from 0 to 45% of diet DM provided to feedlot beef heifers (Homm et al., 2008), whereas serum Se concentration was greater for feedlot beef heifers fed WBG at 34 versus 0% of diet DM (Crickenberger and Johnson, 1982). Thus, we hypothesized that including WBG to corn-based supplements will enhance CP intake and growth and alter the concentrations of plasma fatty acids and liver trace minerals of beef heifers fed medium-quality fescue hay. Our goals were to evaluate growth and concentrations of plasma fatty acids and liver trace minerals of preconditioning beef heifers fed isocaloric amounts of supplements with 0, 50, and 100% of ground corn replaced with WBG.

MATERIALS AND METHODS

All procedures for the experiment conducted in July and August 2014, at the Mountain Research Station (Waynesville, NC), were approved by the North Carolina State University Institutional Animal Care and Use Committee.

Animals and Diets

At approximately 14 d after weaning (d 0), Angus beef heifers (n = 27; BW = 218 ± 3 kg; age = 225 ± 23 d) were stratified by BW and age and randomly assigned into 1 of 9 concrete floor pens (3 heifers per pen; 18 × 4 m; 24 m^2/heifer) in a partially covered feedlot facility. Treatments were randomly assigned to pens (3 pens per treatment) and consisted of heifers receiving supplementation with (1) 100% finely ground corn (**CN**); (2) 100% WBG; or (3) a 50:50 mixture of CN and WBG (**CNWBG**; DM basis). Supplements were provided once daily at 0800 h rom d 0 to 42. The CNWBG supplement was hand mixed daily immediately before feeding. Supplement DM offered to each pen was adjusted on d 0 and 21, using the average BW of each pen, to provide equal daily rate of supplemental TDN (0.7% of BW) among treatments. Free-choice access to ground tall fescue hay (average length of 4 cm; range of 2 to 6 cm; Tables 1 and 2), water, and a complete mineral mix (RU-MIN 1600, Southern States, Richmond, VA; DM basis: 18.2, 0.72, 0.88, 0.76, 7.0, 10.8, and 2.9% of Ca, K, Mg, S, Na, Cl, and P, respectively, and 29, 1,220, 2,130, 29, and 2,530 mg/kg of Co, Cu, Mn, Se, and Zn, respectively) was provided throughout the experiment. Ground hay was provided in amounts to ensure a refusal amount of at least 20% of initial offer, whereas supplement daily offer was consumed entirely within 6 h after supplementation. Hay and supplements were provided in opposite ends of the concrete feed bunk, whereas the complete mineral mix was provided in a plastic bunk attached inside the concrete feed bunk. Chemical composition of individual ingredients and hay are shown in Tables 1 and 2.

Sample Collection and Laboratory Analysis

Individual shrunk BW of heifers was obtained on d 0, 21 and 42, after 16 h of feed and water withdrawal. Concentrations of DM of hay and supplement offered were obtained by drying daily samples in a forced-air oven at 56°C for 48 h (corn and hay) or 120 h (WBG), whereas DM concentration in hay refused was obtained by drying daily samples in a forced-air oven at 56°C for 48 h. Hay and supplement DMI were determined from each pen daily by subtracting the DM of the daily refusal from the DM of the daily offer of hay and supplement. Daily hay and supplement DMI were pooled by week before statistical analysis. Samples of hay and supplement offered were collected on d 0, 15 and 30 and sent in duplicates to a commercial laboratory (Dairy One Laboratory, Ithaca, NY) for wet chemistry analysis of all nutrients (Tables 1 and 2). Samples were analyzed for concentrations of CP (method 984.13; AOAC International, 2006), ADF (method 973.18 modified for use in an Ankom 200 fiber analyzer; Ankom Technology Corp., Fairport, NY; AOAC International, 2006), and NDF (Van Soest et al., 1991; modified for use in an Ankom 200 fiber analyzer; Ankom Technology Corp.). Concentrations of TDN were calculated using equations proposed by Weiss et al. (1992), whereas NE_m and NE_g were calculated with the equations proposed by the NRC (1996). Samples of mineral mix were collected on d 0 and 42 and sent to a commercial laboratory (Dairy One Laboratory) for the analysis of mineral concentrations. One of our objectives was to evaluate the accumulative effects of including WBG to supplements on overall nutrient intake and growth performance of preconditioning beef heifers rather than evaluating the weekly intake of each nutrient. Hence, only overall daily intakes of TDN, CP, RDP, RUP, and individual minerals were estimated using the average chemical composition of hay and supplement samples collected on d 0, 15, and 30.

On d 35, heifers were randomly selected from each pen (2 heifers per pen) for a single liver biopsy, using the procedure previously described by Arthington and Corah (1995), to calculate the effects of including WBG to supplements on liver trace mineral status. Following collection, liver samples (100 mg of wet liver tissue) were kept frozen at −80°C and then sent to Michigan State University (Animal Health Diagnostic Laboratory, Lasing, MI) for analysis of trace mineral concentrations using inductively coupled plasma-atomic spectroscopy, as described by Brasel-