The Professional Animal Scientist 33:166–175
https://doi.org/10.15232/pas.2016-01511

Yeast cell wall supplementation alters the performance and health of beef heifers during the receiving period[1,2]

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ABSTRACT

A study was designed to determine the effect of feeding yeast cell wall (YCW) on performance of newly received crossbred heifers (n = 140; 225 ± 9.4 kg). Heifers were sorted by source (n = 2) and arranged in a completely randomized block design (35 pens; 7 pens per treatment; 4 heifers per pen). Heifers were separated into treatments [control (CON), YCW A (2.5 g/d per head), YCW AA (5.0 g/d per head), YCW B (2.5 g/d per head), or YCW C (2.5 g/d per head)] and fed for 56 d. Daily DMI and individual BW (every 14 d) were collected. On d 56, cattle from treatments CON, YCW A, and YCW C (21 pens; 7 pens per treatment; 4 heifers per pen) were fitted with vaginal temperature (VT) recording devices. On d 63 cattle were weighed and challenged with a s.c. dose (0.5 μg/kg of BW) of lipopolysaccharide (LPS). A final BW was collected and VT devices were removed after 14 d. A significant source × treatment interaction was detected, and data were separated accordingly. In source 1, YCW C heifers exhibited greater BW at d 42 and ADG from 0 to 42 d compared with all other treatments ($P = 0.02$ and $P < 0.01$). In source 2, an increased linear effect for YCW A was detected for BW, ADG, and G:F from d 0 to 14. Following the s.c. LPS challenge, source 1 YCW C heifers exhibited greater ADG ($P < 0.01$) and G:F ($P = 0.01$) compared with CON. In source 2, no significant differences in performance were observed after LPS ($P > 0.62$). There was an increase in VT in all treatments after LPS ($P < 0.01$), with YCW C maintaining greater VT after LPS than CON and YCW A ($P < 0.05$) for both sources. These results suggest that YCW supplementation can improve ADG and DMI during the receiving period and affect the physiological response to a mild endotoxin challenge during moderate to severe heat stress.

Key words: yeast cell wall, heifer, performance, stress

INTRODUCTION

The receiving period into the feedlot is perhaps the most critical time during the feeding period. Calves often experience stress during this time due to weaning, transportation events, exposure to new pathogens, and other changes. Blecha et al. (1984) reported that stress can have negative effects on the immune system during a time when calves may be exposed to new pathogens as a result of commingling. Buhman et al. (2000) reported that most cattle are treated for bovine respiratory disease (**BRD**) during the first 27 d of the feeding period. Treatment for BRD is consistently associated with decreased performance (Bateman et al., 1990; Gardner et al., 1999; Schneider et al., 2009). By improving immune system function and increasing intake during the receiving period, performance traits such as gain can be positively affected throughout the entire feeding period, thereby increasing profitability. Eicher et al. (2010) reported that dietary supplements can alter the immune system and assist calves during the receiving period when cattle are exposed to multiple stressors. *Saccharomyces cerevisiae* is a yeast that has been studied for use in cattle based on its reported beneficial effects on animal growth, immune function, and inhibition of pathogen adhesion within the gastrointestinal tract (Jurgens et al., 1997; Perez-Sotelo et al., 2005). Yeast and yeast cell wall (**YCW**) supplementation has been demonstrated to have positive effects on cattle performance during the receiv-

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ing period. Specifically, Phillips and Von Tungeln (1985) reported that yeast culture increased DMI and ADG of stressed calves in 2 trials. Firon et al. (1983) showed that the mannan component of YCW is capable of binding to receptors of pathogenic bacteria such as *Escherichia coli* and *Salmonella*, thereby preventing adhesion and colonization in the intestine. It has also been reported that β-glucan components of yeast and YCW have the ability to stimulate the release of cytokines, such as tumor necrosis factor-α (Majtán et al., 2005). Based on these data, the objectives of this study were to (1) examine the effects of 3 YCW products on animal performance and health during a 56-d receiving period and (2) determine the effects of these products on animal performance and vaginal temperature response to a s.c. endotoxin challenge.

MATERIALS AND METHODS

Cattle

All procedures involving live animals were approved (#10085–11) by the Texas Tech University Animal Care and Use Committee. A total of 162 crossbred beef heifers, purchased from auction barns in San Saba and Fredericksburg, Texas, arrived in 2 loads (received April 15 and April 21, 2011) at the Texas Tech University Beef Center near New Deal, Texas. Off-truck weights were 225.6 ± 8.33 kg and 224.4 ± 9.62 kg for loads 1 and 2, respectively. The cattle were housed in dirt pens with ad libitum access to sudangrass hay on arrival and processed the following morning. Initial processing of both groups (on the mornings of April 16 and April 22) included (1) measurement of BW [Pearson squeeze chute, Thedford, NE; set on 4 electronic load cells (Gallagher Smart Scale Systems, North Kansas City, MO; readability of ±0.91 kg); scales were calibrated with 454 kg of certified weights (Texas Department of Agriculture) before use]; (2) individual identification by ear tag; (3) vaccination with an infectious bovine rhinotracheitis, bovine viral diarrhea, parainfluenza 3, bovine respiratory syncytial virus vaccine (Vista 5, Intervet/Schering-Plough Animal Health, De Soto, KS); (4) vaccination with a clostridial bacterin toxoid (Vision 7, with SPUR, Intervet/Schering-Plough Animal Health); (5) treatment for internal and external parasites with ivermectin pour-on (Durvet Inc., Blue Springs, MO); and (6) antibiotic treatment with Micotil (Elanco Animal Health, Greenfield, IN). Heifers were allowed ad libitum access to sudangrass hay until the beginning of the trial and implanted with Ralgro (36 mg of zeranol, Intervet/Schering-Plough Animal Health) on d 0. Twenty-two calves were excluded from the study based on weights and overall condition at initial processing.

Experimental Design, Treatment, and Pen Assignment

Loads 1 and 2 were weighed on d 0 (April 20 and April 22, 2011, respectively). Heifers were blocked by BW within their respective load (4 blocks in load 1 and 3 blocks in load 2). Within a block, 5 treatments were assigned to

Table 1. Diet composition

	Concentrate in diet, %, DM basis		
Ingredient, %, DM basis	65	75	85
Corn grain, steam flaked	45.75	57.15	67.90
Cottonseed, hulls	25.00	15.00	5.00
Alfalfa hay, mid bloom	10.00	10.00	10.00
Cottonseed meal, Sol-41%CP[1]	10.50	9.00	7.00
Molasses, cane	4.00	4.00	4.00
Tallow	1.00	1.00	2.00
Urea	0.55	0.65	0.80
Limestone	0.80	0.80	0.90
MIN-AD[2]	0.40	0.40	0.40
Receiving supplement[3]	2.00	2.00	2.00

[1]Sol-41%CP is solvent extracted.

[2]MIN-AD (MIN-AD Inc., Winnemucca, NV).

[3]Supplement for the diet contained (DM basis) 66.383% cottonseed meal; 0.500% Endox (Kemin Industries Inc., Des Moines, IA); 0.648% dicalcium phosphate; 10% potassium chloride; 4.167% ammonium sulfate; 15.000% salt; 0.002% cobalt carbonate; 0.196% copper sulfate; 0.083% iron sulfate; 0.003% ethylenediamine dihydroiodide; 0.333% manganese oxide; 0.125% selenium premix (0.2% Se); 0.986% zinc sulfate; 0.010% vitamin A (1,000,000 IU/g); 0.157% vitamin E (500 IU/g); 0.844% Rumensin (176.4 mg/kg; Elanco Animal Health, Indianapolis, IN); and 0.563% Tylan (88.2 mg/kg; Elanco Animal Health). Concentrations in parentheses are expressed on a 90% DM basis.