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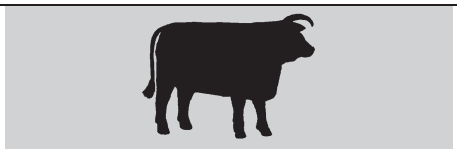

Effects of mannan oligosaccharide on beef-cow performance and passive immunity transfer to calves

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ABSTRACT

This experiment investigated the effects of feeding mannan oligosaccharide to beef cows during late gestation through 30 d of lactation on cow and calf performance and calf passive immunity. Angus and Angus × Hereford cows (n = 69; BW = 569 ± 68 kg; age = 5.3 ± 7 yr) were allotted by BW and age in a completely randomized designed. Cows were assigned to 1 of 2 treatments including 1) 1.36 kg/d during gestation of a cottonseed meal–based 30% CP supplement and 1.81 kg/d during lactation of a cottonseed meal–based 38% CP supplement (control); 2) control plus 10 g/d of Bio-Mos (Bio-Mos; Alltech Inc., Nicholasville, KY). Experimental supplementation began on February 14, 2012, and was terminated after cows consumed the lactation diet for at least 30 d. Cow and calf blood and colostrum were collected within 12 h of parturition. Cows fed Bio-Mos tended to maintain more BW from parturition through the end of the feeding period (P = 0.10). Similarly, cows consuming Bio-Mos were better able to maintain BCS from initiation of the experiment through weaning (P = 0.05). At parturition, no differences for IgG_1 concentrations in colostrum (P = 0.28), cow serum (P = 0.19), or calf serum (P = 0.70) were detected. Similarly, parturition calf serum IgG_2, IgA, or IgM concentrations were not different (P > 0.14). Adding Bio-Mos to winter supplement may limit BCS loss following parturition in spring-calving beef cows; however, there was no effect on passive immunity characteristics.

Key words: calf, cow, immunity, mannan oligosaccharide

INTRODUCTION

Colostrum is particularly important to the health of the calf because the bovine placenta does not allow Ig to pass from dam to calf in utero, making the calf relatively defenseless against infectious disease challenges at birth (Waldner and Rosengren, 2009). Colostrum provides a complete diet after birth, as well as providing the antibodies necessary to survive. Improving the quality and quantity of Ig may alleviate morbidity and mortality among calves in the first weeks of life. Nutritional modifications to the milk replacer in the dairy industry to enhance Ig in colostrum have included using antibiotic alternatives such as direct-fed microbials or mannan oligosaccharide (Bio-Mos). Mannan oligosaccharide, in the form of Bio-Mos (Alltech Inc., Nicholasville, KY), comes from the cell wall of *Saccharomyces cerevisiae* yeast and is known to block colonization of pathogens in the digestive tract while improving immune function (Franklin et al., 2005; Che et al., 2011). An affordable nonantibiotic that may increase health and growth performance such as Bio-Mos may be valuable to the livestock industry (Franklin et al., 2005). Feeding Bio-Mos to sows in late gestation (12 to 14 d prefarrowing) has been shown to increase piglet weaning BW compared with piglets from sows fed a control diet without Bio-Mos (Newman and Newman, 2001; O'Quinn et al., 2001). Including Bio-Mos in the dairy calf milk replacer has provided mixed results, in either improving intake (Terré et al., 2006; Morrison et al., 2010) or im-

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proving gain (Heinrichs et al., 2003) by comparison to antibiotics, probiotics, or no additions to the milk in the 3 experiments, respectively. Franklin et al. (2005) found no improvements in dairy-cow BW or Ig concentration of cow serum, calf serum, or colostrum when they fed Bio-Mos to the cows 30 d before parturition. Research indicating an improvement in the transfer of high-quality passive immunity, as measured by Ig concentration, from dairy cow to offspring due to the addition of Bio-Mos is limited. Currently there is no published research evaluating the effect of Bio-Mos on passive immunity characteristics from beef cows to their offspring. Therefore, the objective of this experiment was to investigate the effects of feeding Bio-Mos to beef cows during late gestation through 30 d of lactation on cow and calf growth performance and passive immunity transfer to the calf.

MATERIALS AND METHODS

Animals

All animal procedures were conducted in accordance with the approved Oklahoma State University Animal Care and Use Protocol. This experiment was conducted at the Range Cow Research Center, North Range Unit, located approximately 16 km west of Stillwater, Oklahoma. Spring-calving Angus and Angus × Hereford cows (n = 69; 569 kg initial BW; SE = 8.14 kg; 5.5 initial BCS; SE = 0.07; 5.3 yr initial age; SE = 0.38 yr) were assigned to 1 of 2 dietary supplements in a completely randomized design. Cows were ranked by BW and age and randomly allocated so that BW and age were similar across treatments. Treatment supplements (DM basis) included 1) 1.36 kg/d during gestation of a cottonseed meal–based 30% CP supplement and 1.81 kg/d during lactation of a cottonseed meal–based 38% CP supplement (control); 2) control plus 10 g/d of Bio-Mos (Bio-Mos). Supplements were fed as 0.97-cm-diameter pellets and were balanced for Ca, P, and vitamin A to meet or exceed NRC (1996) protein requirement of the cow. The gestation control supplement was formulated to provide 27% NDF, 14% ADF, 2.4% fat, 1.11% P, and 0.21% Ca. All cows had ad libitum access to prairie hay (5% CP, 74% NDF, DM basis) for the duration of the experiment.

Individual-animal experimental supplementation began on February 14, 2012, and was terminated after cows consumed the lactation diet for at least 30 d. Cows that had not calved by April 10, 2012, were removed from the study, resulting in 38 and 31 cows on the control and Bio-Mos treatments, respectively. All supplementation ended on May 1, 2012, resulting in an experimental treatment period ranging from 52 to 80 d.

Each morning at approximately 0800 h cows were fed individually in a barn containing 31 individual feeding stalls to ensure that each cow received the assigned amount of feed. Each day the cows were gathered from a pasture adjacent to the feeding barn and placed into a feeding stall, restrained, and allowed 20 min to consume their dietary supplement. Each cow thoroughly consumed the dietary supplement for the duration of the experiment. Cows were fed the gestation supplement until parturition, when they were switched to the lactation supplement for the duration of the experiment. Cow-calf pairs were separated while the dam consumed the supplement and then rejoined each day.

Cows were managed as a contemporary group during both gestation and lactation. During gestation, cows remained in a single pasture (6 ha) with free access to tall-grass prairie hay (5% CP, 74% NDF, DM basis). At parturition, pairs were moved to a nearby pasture (6 ha) where they had access to tall-grass prairie hay matching the nutrient composition as described above.

Individual cow BW, BCS (scale 1 through 9; Wagner et al., 1988), blood, and fecal samples were collected at initiation of the experiment on February 10, 2012. Blood was collected via coccygeal venipuncture into vacuum tubes (BD Vacutainer) to establish immune-system parameters of the dam. Blood samples were analyzed for serum Ig concentrations and serum protein concentrations. Approximately 40 g of feces was collected by rectal grab and analyzed for presence of *Salmonella* and coccidiosis. All cows calved without assistance. Within 3 to 12 h from parturition, an individual BW was recorded and a blood sample was collected from each cow (coccygeal venipuncture) and calf (jugular venipuncture). A colostrum sample was also collected from the cow at this time. Cows received a 1.0-mL injection of oxytocin (20 USP units/mL, i.m.; Phoenix Pharmaceutical Inc., St. Joseph, MO) to facilitate milk letdown. A total of 250 mL of colostrum was collected uniformly from all quarters from each cow. Colostrum was immediately analyzed for colostrum quality using a Colostrometer (BIOGENICS, Mapleton, OR), and colostrum samples were frozen at −20°C for later analysis of Ig concentration. Rectal grab samples of feces were collected from the cow approximately 14 d after parturition and at the end of the experiment. After approximately 30 d of consuming the lactation supplement, cows were removed from dietary treatments. At this time, individual BW and BCS were recorded and a fecal sample was collected from each cow. Individual BW, fecal sample, and jugular-venipuncture samples were collected from each calf also at this time, which concluded the feeding portion of the experiment. At weaning on September 11, 2012, cow BW and BCS, along with calf BW, were also recorded. Calf BW at weaning was adjusted to a 205-d BW with a dam age adjustment factor according to the Beef Improvement Federation and Guidelines (2002).

On February 10, 2012, all cows received an injection of Endovac-Bovi (IMMVAC Inc., Columbia, MO) for protection against *Escherichia coli* mastitis. On May 9, 2012, the cows underwent a prebreeding vaccination program that included Safe Guard dewormer (Merck Animal Health, Summitt, NJ), Express FP-10 vaccine