

Mannan oligosaccharides in diets of mares: effects on mares and their foals

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Diarrhea in suckling foals is a major cause of wastage and veterinary expenses in horse breeding farms. A number of organisms may be involved including, *Clostridium perfringens*, *Clostridium difficile*, *Salmonella typhimurium* and other *Salmonella spp.*, *Ehrlichia risticii* and *rotavirus*. Protection from these organisms includes a clean environment to minimize exposure, passive immunity in the foal via the colostrum, and in some cases preemptive antibiotic treatment. In recent years there has been a high incidence of diarrhea in the University of Florida's Horse Research Center breeding herd. In 2001, we decided to evaluate products reported to influence immune response and to have the ability to influence gut microbial populations.

Materials and methods

Twenty-one Thoroughbred and Quarter Horse mares were blocked by foaling date and assigned to control (no supplement), Ribose (75 g/day) or Bio-Mos (10 g/day) treatments. All received bahiagrass pasture and/or coastal bermudagrass hay to appetite and a concentrate formulated to provide NRC (1989) or higher levels of nutrients when fed with the specified forages (Table 1). The concentrate was fed at 0.75 kg/100 kg BW daily from -56 to -28 days, 1.0 kg/100 kg BW daily from -28 to foaling, 1.5 kg/100 kg BW daily from foaling to +84 days and at 1.0 kg/100 kg BW daily from +84 days to weaning. Concentrate intake was adjusted for body condition by increasing concentrate 20% for every unit below 5 and decreasing it by 20% for every unit above 5. Ribose and Bio-Mos supplements were top-dressed on the morning feeding.

Table 1. Formulation and nutrient content of concentrate.

Ingredients	%
Corn, cracked	34.25
Oats, steamed rolled	26.30
Wheat bran pellets	10.00
Soybean meal pellets	10.15
Dehydrated alfalfa pellets	7.50
Monocalcium phosphate	0.80
Calcium carbonate	1.50
Salt	0.75
Vitamin premix + TM premix	0.60
Vitamin E premix	0.15
Lysine	0.05
Mold inhibitor	0.075
Molasses	8.00
Nutrient composition	
Dry matter, %	88.15
Dig. energy, Mcal/kg*	3.34
Crude protein, %*	16.0
Calcium, %*	1.2
Phosphorus, %*	0.6

Dry matter basis

Mare weight, heart girth and condition score were recorded at the start of the experiment and at 28 day intervals until weaning. Blood samples were collected from the mares at -28, 0 (foaling), +28 and +56 days. Colostrum was collected from the mares within 6 hr of parturition and milk samples collected day 3. Foals were weighed and measured for withers height, heart girth, body length and hip height at birth and at 28 day intervals to weaning at 112 days. Fecal scores were assigned to each foal daily to assess the gastrointestinal health status of the foal. Blood from mares and foals, colostrum and milk were analyzed for IgG, IgA, and IgM.

Results

Two mares aborted prior to due date and all data were excluded from the record. A third mare had a septic foal that died shortly after birth. Her data were also excluded. There was no difference in weight or condition score of mares among treatment groups. Foals from the Bio-Mos treated mares were smaller than the foals from the other two groups at birth and they did not catch up by the end of the experiment (Table 2).

Table 2. Weights and measurements of foals from dams fed ribose, Bio-Mos or no supplement.

	Age (days)					
	0	14	28	56	84	112
Weight, lb						
Control	118	174	220	300	359	448
Ribose	123	171	213	290	362	431
Bio-Mos	93	115	186	145	324	398
P =	0.01	0.03	0.05	0.02	0.16	0.098

Serum IgG, IgA, and IgM values for the mares were not influenced by diet (Table 3). Although mares on the Bio-Mos treatment had higher IgA values and tended to have numerically higher IgG and IgM values than the other two groups, these differences were present at the start of the experiment and may have not been due to the diets. Several mares starting dripping milk prior to parturition (11 hr to 12 days). It was determined that the colostrum collected from these mares after parturition was considerably lower in IgG than for those mares that did not leak milk, and their foals were provided supplemental colostrum.

Table 3. Serum and colostrum IgG, IgA and IgM values for mares fed ribose and BioMos.

	Serum				Colostrum	Milk day 3
	-28 d	foaling	+28 d	+56 d		
<i>Mare IgG</i>						
Control	2091	1841	2100	2010	13216	122
Ribose	2293	1967	2138	2268	16481	120
Bio-Mos	2507	2146	2377	2561	20007	160
P =	0.63	0.64	0.81	0.47	0.15	0.42
<i>Mare IgA</i>						
Control	401	490	499	506	133	35
Ribose	381	415	469	489	117	54
Bio-Mos	694	719	721	809	170	74
P =	0.03	0.01	0.06	0.01	0.73	0.71
<i>Mare IgM</i>						
Control	137	155	136	121	199	12
Ribose	167	168	143	166	294	18
Bio-Mos	164	179	157	173	295	23
P =	0.44	0.70	0.73	0.24	0.35	0.37

Foal serum IgG and IgA values were not different between groups, but foal IgM values were higher for the foals from mares supplemented with Bio-Mos on day 0 (Table 5). IgG values gradually decreased to 56 days with the Bio-Mos foals having a numerical advantage throughout the study. Fecal scores on the foals revealed that part of the foals exhibited diarrhea at about 56 days of age. In all cases the diarrhea was treated successfully and the foals recovered. There was more diarrhea in the Control foals than the other two groups. Five of the six control foals exhibited diarrhea severe enough to be treated (Table 6). Three of the foals from the ribose-treated mares and none of the foals from the Bio-Mos-treated mares exhibited severe diarrhea (P = 0.021).

Conclusions

The data suggest that Bio-Mos supplementation may have caused the mares to secrete additional antibodies in the colostrum and that the foals receiving these antibodies were better able to cope with microbial challenges to the digestive system.

Table 5. Serum IgG, IgA and IgM concentrations from foals from mares fed ribose and BioMos.

	n	Days				
		0	7	14	28	56
<i>IgG</i>						
Control	4	2,248	1,956	1,657	1,079	646
Ribose	5	2,662	2,619	1,911	1,468	827
Bio-Mos	2	3,450	2,916	2,605	1,433	950
P =		0.34	0.15	0.07	0.33	0.16
<i>IgA</i>						
Control	4-6	254	168	38	38	52
Ribose	5	234	142	52	43	70
Bio-Mos	3-5	374	191	54	43	88
P =		0.29	0.59	0.71	0.86	0.37
<i>IgM</i>						
Control	4-6	55	40	39	38	96
Ribose	5-7	59	44	48	75	114
Bio-Mos	3-5	109	65	63	57	77
P =		0.04	0.18	0.36	0.02	0.05

Table 6. Influence of Bio-Mos and Ribose supplementation of mares on incidence of diarrhea in the foals.

	Diarrhea ¹	
	No	Yes
Control	1	5
Ribose	4	3
Bio-Mos	5	0

¹Only diarrhea severe enough to justify treatment. Chi-square = 0.021.