J. Dairy Sci. 97:3081–3098
http://dx.doi.org/10.3168/jds.2013-7692

Effects of feeding various dosages of *Saccharomyces cerevisiae* fermentation product in transition dairy cows

E. M. Zaworski,* C. M. Shriver-Munsch,* N. A. Fadden,* W. K. Sanchez,† I. Yoon,† and G. Bobe*‡[1]
*Department of Animal and Rangeland Sciences, Oregon State University, Corvallis 97331
†Diamond V, Cedar Rapids, IA 52404
‡Linus Pauling Institute, Oregon State University, Corvallis 97331

ABSTRACT

Feeding 56 versus 0 g/d of *Saccharomyces cerevisiae* fermentation product (SCFP; Diamond V Original XP; Diamond V, Cedar Rapids, IA) can increase feed intake and milk production in transition dairy cows. To evaluate the effects of various dosages of SCFP, Holstein cows were given individually a supplement containing 0 (n = 14), 56 (n = 15), or 112 g (n = 13) of SCFP daily during morning lockup as a topdressing to their total mixed ration. The supplement consisted of 0, 56, or 112 g of SCFP mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively. Supplement feeding began 28 d before predicted calving date (no less than 14 d) and ended 28 d postpartum, and supplement intake was evaluated daily. Blood samples were collected at d −21, −14, −7, −3, −1, 0, 1, 3, 7, 14, 21, and 28 to measure serum concentrations of macrominerals, metabolites, acute-phase proteins, immunoglobulin, and hormones. Milk weights were measured and milk samples were collected 2 times/wk on nonconsecutive days and analyzed for milk fat, protein, lactose, and somatic cell count (SCC). During the first day after calving, feeding SCFP versus no SCFP decreased serum cortisol concentrations and at least tended to increase supplement intake and serum concentrations of calcium, glucose, urea N, and serum amyloid A. During the first 4 wk postpartum, feeding SCFP versus no SCFP decreased milk SCC and increased milk production and serum phosphorus concentrations. Feeding 112 versus 56 g of SCFP/d did not show additional effects. Feeding SCFP may have a dosage-independent beneficial effect in supporting the physiologic adaptations after parturition, resulting in higher milk production and lower milk SCC.

Key words: dairy cow, immune function, metabolic status, yeast culture

INTRODUCTION

The transition period, generally defined as 3 wk prepartum to 3 wk postpartum, is a critical time period in the life of dairy cows because increased nutritional and energy demands exceed intake, resulting in tremendous physiological challenges to maintain homeostasis at the onset of lactation (Overton and Waldron, 2004). The physiological challenges include immune function, which is suppressed in the transition period, resulting in increased disease susceptibility (Nonnecke et al., 2003; Ohtsuka et al., 2006). Feeding ruminal fermentation modifiers during the transition period could be a cost-effective and safe way to increase DMI and maximize feed utilization and thereby improve milk production and decrease the risk of disease (Eastridge, 2006). One of the most widely used ruminal fermentation modifiers is the *Saccharomyces cerevisiae* fermentation product (**SCFP**; Original XP; Diamond V, Cedar Rapids, IA). *Saccharomyces cerevisiae* fermentation product improves dietary nutrient and energy availability and milk production by promoting cellulolytic, proteolytic, and lactate-utilizing bacteria in the rumen (Harrison et al., 1988; Callaway and Martin, 1997). Feeding 56 to 60 g of SCFP/d to transition dairy cows increased DMI and milk production by 2 to 5%, on average (Robinson and Garrett, 1999; Dann et al., 2000; Ramsing et al., 2009). Results in dairy calves, pigs, and chicken suggest that feeding SCFP may also improve immune function (Magalhães et al., 2008; Gao et al., 2009; Shen et al., 2009) by activating the innate and adaptive immune response (Jensen et al., 2008c).

We hypothesized that higher dosages of SCFP may be required during the transition period to overcome the nutrient and energy demands associated with parturition and onset of lactation. Dose-response studies of feeding SCFP to lactating dairy cows are limited. We previously compared feeding 0, 57, and 227 g of SCFP/d to transition dairy cows and observed no differences in lactation performance, energy status, and feed intake behavior between 57 and 227 g/d (Ramsing et al., 2009). The objectives of this study were to determine in transition dairy cows (1) the effects of periparturient

Received November 7, 2013.
Accepted January 26, 2014.
[1]Corresponding author: gerd.bobe@oregonstate.edu

SCFP supplementation on indicators of macromineral status (serum calcium, magnesium, and phosphorus), nutrient status (serum glucose and urea N), energy status (BCS and serum NEFA and BHBA), inflammation as part of the innate immune status [haptoglobin and serum amyloid A (**SAA**)], adaptive immune status (IgG, IgM, and IgA), and hormones involved in these physiological processes (cortisol and insulin) and (2) the effects of feeding 112 versus 56 g of SCFP/d, which, to our knowledge, have not been examined.

MATERIALS AND METHODS

Animals and Diets

All procedures involving animals were conducted in accordance with Oregon State University (Corvallis) Institutional Animal Care and Use (ACUP no. 3991). The study was conducted on a commercial dairy farm close to Oregon State University. To be eligible for the study, cows had to be purebred Holsteins, healthy, have completed ≥1 lactation, and have a BCS of ≥3.0 at the start of the study. Cows (n = 45; 2 to 6 upcoming parities) were blocked by upcoming parity (2 or 3 and higher) and randomly assigned within blocks to treatments. Calving dates and previous 305-d mature equivalent values were evenly represented across treatments. The treatment consisted of 0 (control), 56, or 112 g of SCFP/d mixed with 84 g of molasses and 168, 112, or 56 g of corn meal, respectively (Table 1). Daily, the supplement was top-dressed individually to each cow during the morning feeding when cows were locked in head stanchion lockups for a period of 30 to 45 min. The treatment period started 4 wk before the expected calving date and ended 4 wk after calving. Three cows did not complete the study because of treatment-unrelated causes (1 cow developed prepartum leg and feet problems; 1 cow developed prepartum toxic mastitis; 1 cow had her uterus torn at calving). The remaining 42 cows (control: 14 cows, 56 g of SCFP/d: 15 cows, and 112 g of SCFP/d: 13 cows) completed the study and were used for statistical analysis.

During the last 4 wk before expected calving, cows were housed in a straw-bedded freestall barn and were fed once in the morning (0730 h) a TMR based on corn, corn silage, and alfalfa and triticale hay, which met NRC (2001) guidelines (Table 2). After calving, cows stayed the first 48 h in the hospital pen, and then for the remaining 26 d in the early lactation pen. Cows that had twins (control: 1 cow; 56 g of SCFP/d: 5 cows; and 112 g of SCFP/d: 2 cows) or appeared lethargic after giving birth, or both, received i.v. 0.5 L calcium-magnesium-phosphorus-potassium-dextrose (CMPK) solution (Aspen Veterinary Resources Ltd., Liberty, MO) and 0.5 L of dextrose (50% dextrose; Aspen Veterinary Resources Ltd.) and orally a 37.85-L drench [907 g of Fresh Cow Drench (TPi, Madera, CA) and 237 mL of propylene glycol dissolved in 37.85 L of water]. Cows diagnosed with infectious or metabolic disorders stayed or were moved in the hospital pen for treatment. Cows from the hospital and early-lactation pen were fed at 0700 and 0900 h, respectively, and 1330 h for all cows, a TMR based on corn, corn silage, and alfalfa hay, which met NRC (2001) guidelines (Table 2). The TMR was tested for nutrient composition by Dairy One Inc. (Ithaca, NY). Cows in the hospital and early-lactation pen were milked 2 and 6 times/d, respectively.

During the study period, cows were monitored daily for abnormal milk, gait, appetite, general appearance, alertness, vaginal discharge, and retained placenta. Uterine discharge was checked 2 times/wk. Urinary ketones and body temperature were checked if the cow appeared unhealthy, which included depressed feed intake (feeding behavior of all cows were monitored daily), lethargy, cold ears, and rapid BCS loss. Infectious and metabolic disorders were diagnosed and treated based on standard operating procedures developed by the Oregon State University veterinary staff and consistent with standards of veterinary care practices. Diagnosis and treatment of infectious and metabolic disorders was done by the herd manager who was trained and supervised by the Oregon State University veterinarian, who came at least once per week to supervise diagnosis and treatment of infectious and metabolic disorders. The herd manager was blinded to the dietary treatment allocation. Except for emergencies, cows were treated during morning lockup and after blood samples were taken.

Data Collection

Three trained evaluators independently determined BCS on a 5-point scale (Edmonson et al., 1989). Start-

Table 1. Composition of dietary supplements

	Treatment[1]		
Ingredient (g)	Control	56 g of SCFP/d	112 g of SCFP/d
SCFP[2] (g/d)	0	56	112
Corn meal[3] (g/d)	168	112	56
Molasses[4] (g/d)	84	84	84

[1]SCFP = *Saccharomyces cerevisiae* fermentation product (Diamond V Original XP; Diamond V, Cedar Rapids, IA).

[2]Minimum of 12.0% CP, minimum of 3.0% crude fat, and maximum of 6.5% crude fiber.

[3]CHS Nutrition (Sioux Falls, SD).

[4]Minimum of 5.0% CP, minimum of 33.0% total sugars, and maximum of 35% moisture (CHS Nutrition).