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Effect of feeding yeast culture on reproduction and lameness in dairy cows under heat stress

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ABSTRACT

Multiparous Holstein cows ($n = 717$) from two dairy farms were blocked at calving by parity and previous lactation milk yield and, within each block, randomly assigned to one of two treatments: a diet containing no yeast culture (Control; $n = 359$) or 30 g/d of a culture of *Saccharomyces cerevisiae* (YC; $n = 358$) from 20 to 140 d postpartum. Only cows calving during months of heat stress, May–August were enrolled. Lameness score (1–5 scale) was evaluated at study enrollment and again at 100 d postpartum. The body condition score (BCS, 1–5 scale) was evaluated at calving, 28, 58 and 140 d postpartum. Cows received two injections of $PGF_{2\alpha}$ at 37 and 51 d postpartum, and those observed in estrus were inseminated. Cows not in estrus were enrolled in a timed AI protocol at 65 d postpartum and inseminated at 75 d postpartum. Ovaries were examined by ultrasonography at 37 and 51 d postpartum to determine whether estrous cycling had been initiated by the presence of a corpus lutem (CL) in at least one of the two examinations. Pregnancy was diagnosed at 31, 38 and 66 d after the first AI and at 38 and 66 d after the second and third AI. Diet did not affect time of onset of estrous cycles postpartum, and 8.2% of the cows were anovular. Detection of estrus in the 7 d after the second injection of $PGF_{2\alpha}$ was similar for control and YC. For control and YC, conception rates 38 d after AI at first (30.8% and 31.4%), second (39.3% and 35.1%) and third (25.8% and 30.6%) inseminations, and pregnancy losses did not differ, which resulted in similar median days to pregnancy and proportion of pregnant cows at 140 d postpartum. Yeast culture did not affect incidence of lameness, but

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tended to reduce lameness score. Lame cows and anovular cows had lesser conception rates at first AI, and extended interval from calving to conception. A THI of 71 was identified as the critical point in which fertility was reduced in lactating dairy cows, although the sensitivity and specificity were minimal. Cows exposed to a THI > 71 on the day of first AI had a 33% reduction in the rate of pregnancy resulting in extended interval to pregnancy. Feeding a yeast culture of *S. cerevisiae* had minor effects on lameness score, but no impact on reproduction of multiparous cows under heat stress.

1. Introduction

Cultures of *Saccharomyces cerevisiae* are widely used in diets for lactating dairy cows to alter rumen fermentation and promote changes in ruminal digestive processes (Newbold et al., 1996; Wallace, 1996) which, in early lactation, are expected to improve animal health and energy status. Many studies have demonstrated that *S. cerevisiae* can increase dry matter (DM) intake, nutrient digestibility and milk production, and help to stabilize rumen pH (Callaway and Martin, 1997; Dann et al., 2000; Shaver and Garrett, 1997; Wohlt et al., 1998).

Cows in early postpartum undergo a period of negative energy balance (Butler, 2003), which is characterized by increased mobilization of body reserves in support of lactation, particularly from body fat. The increased mobilization of body reserves in early lactation has marked effects on ovarian function and reproductive performance (Butler, 2003; Santos et al., 2004).

In addition to the physiological period of energy deficit, environmental factors that exacerbate energy needs of dairy cows in early lactation can further compromise energy intake and reproductive performance. When heat stressed, cows have reduced feed intake at the same time that nutrient needs for maintenance and thermoregulation increase (West, 2003). Huber et al. (1994) indicated that feeding fungal cultures to lactating dairy cows under heat stress might reduce body temperature and respiration rate. One of the factors that influences heat production in lactating dairy cattle is a greater DM intake to sustain milk yield (West, 2003). Indeed, typical lactation diets with large quantities of forage tend to increase heat production and reducing forage content of the diet has been suggested as one nutritional strategy to minimize heat stress (Huber et al., 1994; West, 2003). However, lesser forage diets can compromise the supply of physically effective fiber and increase risk for digestive disturbance and acidosis, which predisposes cows to lameness (Nocek, 1997). Furthermore, lameness has marked negative effects on reproduction (Garbarino et al., 2004).

One method to improve energy supply to dairy cows and, possibly, minimize heat production is to increase digestibility of the fiber component of the diet. Use of yeast culture increases DM intake and nutrient digestion, which would ameliorate negative effects of heat stress. Nutritional strategies to circumvent the negative effects of heat stress have been suggested as a means to improve reproduction in dairy cows (Hansen and Aréchiga, 1999). Furthermore, yeast culture stabilizes rumen pH by stimulating growth of rumen bacteria that utilize lactic acid, which might minimize the risk for rumen acidosis (Callaway and Martin, 1997) and, therefore, lameness.

It was hypothesized that adding a microbial additive to the diet of early lactation high-producing dairy cows exposed to high ambient temperature might reduce locomotion score and body temperature, and improve reproductive performance. Therefore, objectives of the study were to determine effects of feeding a culture of *S. cerevisiae* on reproduction and lameness in early lactation dairy cows exposed to elevated ambient temperatures.

2. Materials and methods

2.1. Animals, housing, and feeding

Multiparous Holstein cows ($n = 723$) on two commercial dairy farms (Farm 1, $n = 269$; Farm 2, $n = 454$) in the San Joaquin Valley of California were blocked by lactation number and previous