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Association between body condition score change during the dry period and postpartum health and performance

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ABSTRACT

The objectives of the current study were to determine the association between body condition score change during the dry period (ΔBCS) and postpartum health and reproductive and productive performance of Holstein cows. Data from 16,104 lactations from 9,950 parous cows from 2 dairies located in the San Joaquin Valley of California were used. Within dairy, cows were scored for body condition at dry off and parturition by the same herd workers, who were trained by veterinarians from the Veterinary Medicine Teaching and Research Center of the University of California Davis. Cows were classified as having excessive loss of BCS (ΔBCS ≤ -0.75; n = 1,604), moderate loss of BCS (ΔBCS = −0.5 to −0.25; n = 6,430), no change in BCS (ΔBCS = 0; n = 4,819), and gained BCS (ΔBCS ≥ 0.25; n = 3,251). Data regarding morbidity, mortality, and reproductive and productive performance were recorded until 305 d postpartum or until cows were dried off or left the herd. Loss of BCS during the dry period was associated with greater incidence of uterine disease and indigestion. Additionally, loss of BCS during the dry period was associated with greater likelihood of treatment with antimicrobials, anti-inflammatories, and supportive therapy. Loss of BCS during the dry period was associated with reduced likelihood of pregnancy after the first and second postpartum inseminations. Cows that gained BCS during the dry period had greater yield of milk, fat, and protein and had reduced somatic cell linear score in the subsequent lactation. In the current study, loss of BCS during the dry period was a predisposing factor associated with health disorders and reduced productive and reproductive performance in Holstein cows.

Key words: body condition score, dry period, lactating dairy cows, performance

INTRODUCTION

The prepartum period has been identified as critical to the health and performance of lactating dairy cows. Cows that have decreased DMI during the prepartum period and that have greater decrease in DMI in the last days of gestation are more likely to have impaired innate immunity (Hammon et al., 2006) and are more likely to have health disorders (Huzzey et al., 2007). Although not completely understood, the association between reduced DMI peripartum and impaired innate immunity is likely a consequence of several factors, such as reduced IGF-I concentrations (Inoue et al., 1998; Wathes et al., 2009; Sander et al., 2011), increased concentrations of nonesterified fatty acid peripartum (Klucinski et al., 1988; Rukkwamsuk et al., 1999; Hammon et al., 2006), and increased BHB concentrations postpartum (Erb and Grohn, 1988; Gröhn et al., 1989; Correa et al., 1993). A strong positive correlation exists between prepartum and postpartum DMI (Grummer et al., 2004), suggesting that greater milk yield and improved performance should be obtained by minimizing the decline in DMI prepartum. Others have suggested that improvements in metabolic parameters may be achieved by restricting energy intake during the last weeks of gestations, with positive effects on reproductive performance (Cardoso et al., 2013); but questions remain regarding the effects of restricted energy intake prepartum on subsequent milk yield. In large dairy herds, monitoring individual DMI is not possible, and herds that attempt to measure it evaluate DMI of a group and not individuals. Body condition score and BCS change may, however, be used as indirect measures of fatness and energy balance, respectively, for individual cows (Roche et al., 2009).

Reduced BCS at calving is associated with lower milk yield and reduced likelihood of pregnancy, whereas elevated BCS at calving is associated with greater likelihood of postpartum metabolic diseases (reviewed by Roche et al., 2009). North American Holstein cows with BCS >4 in the prepartum period tend to have a

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more dramatic decrease in peripartum DMI and more pronounced and prolonged negative energy balance postpartum compared with thinner cows (reviewed by Grummer et al., 2004). As such, cows with elevated BCS at parturition are more likely to have hepatic lipidosis, ketosis, and displacement of abomasum (Roche et al., 2009; Ospina et al., 2010). Little is known, however, regarding the association between BCS change during the dry period (**ΔBCS**) and postpartum health of dairy cows. Contreras et al. (2004) demonstrated that cows with BCS ≤3 at dry off gained BCS during the dry period and were less likely to have retained fetal membranes compared with cows with BCS ≥3.25 at dry off. Cows managed from late gestation to 21 d before the expected calving date to be thinner (2.75 vs. 3.25) had neutrophils with reduced inflammatory state and an enhanced capacity for microbial destruction (Crookenden et al., 2017). Kadivar et al. (2014) suggested, however, that reduced BCS 2 wk prepartum was associated with increased incidence of clinical endometritis, but change in BCS from 2 wk prepartum to 2 or 4 wk postpartum was not associated with clinical endometritis.

The hypothesis of the current study was that ΔBCS is associated with incidence of postpartum health disorders, yield of milk and milk components, and reproductive performance. Furthermore, we hypothesized that ΔBCS is mainly explained by BCS at dry off (**BCSD**) and that BCSD is a consequence of reproductive and productive performance. The objectives of the current study were to evaluate the associations between ΔBCS and postpartum health and performance of lactating Holstein cows. Additionally, the current study aimed to determine factors associated with ΔBCS in the dry period and BCSD.

MATERIALS AND METHODS

Animals, Facilities, and Management

Holstein cows from 2 commercial dairies located in the San Joaquin Valley of California (Kings County), within 16 km of the city of Hanford, were used in this retrospective observational study. Only data from parous cows (≥1st lactation at dry off) that had gestation length of 256 to 296 d (Vieira-Neto et al., 2017) and that remained in the dry period for 22 to 100 d were used. A total of 5,263 lactations from 3,026 cows from dairy A and 10,841 lactations from 6,924 cows from dairy B met the enrollment criteria and were used in the current study. During the study period, the rolling herd average was 11,329 kg/cow in dairy A and 10,691 kg/cow in dairy B. Lactating cows in dairy A were housed in open lot corrals with capacity for 140 cows. Lactating cows in dairy B were housed in freestall pens with capacity for 160 or 350 cows. During lactation, cows were fed diets formulated to meet or exceed nutrient requirements for lactating Holstein cows weighing 650 kg and producing 45 kg of 3.5% FCM (NRC, 2001). During the dry period, cows were fed 2 diets, one from 60 to 25 d before the expected calving date and the other from 24 d before the expected calving date to calving, formulated to meet the requirements of nonlactating Holstein cows weighing 725 kg, with conceptus gaining approximately 0.6 to 0.7 kg/d, and DMI between 15 (60 to 25 d before the expected calving date) and 10 kg/d (24 d before the expected calving date to calving; NRC, 2001).

Cows were dried off at approximately 220 d of gestation. At dry off, cows received an intramammary treatment with a long-acting antimicrobial for the prevention of mastitis. In dairy A, cows were housed in open lot corrals during the entire dry period. In dairy B, far-off (60 to 25 d before the expected date of parturition) cows were housed in either open lot corrals or freestall pens, and close-up (24 d before the calving date to parturition) cows were housed in open lot corrals.

BCS and Classification

Body condition score was assessed on the day cows were dried off and at the maternity pen immediately after parturition. The herd personnel was trained by veterinarians of the Veterinary Medicine Teaching and Research Center of the University of California Davis to use the visual technique to determine the BCS on a scale of 1 (severe underconditioning) to 5 (severe overconditioning) in 0.25 increments (Ferguson et al., 1994). Cows were classified according to ΔBCS as excessive loss (**ELBCS**; ΔBCS ≤−0.75 unit), moderate loss (**MLBCS**; ΔBCS = −0.50 to −0.25), no change (**NCBCS**; ΔBCS = 0), and gained BCS (**GBCS**; ΔBCS ≥0.25) during the dry period. Moderate loss of BCS included cows with ΔBCS −0.50 and −0.25 because, in a preliminary analysis of pregnancy to first postpartum AI and mean milk yield in the first 60 DIM, no differences were observed between these cows, but cows with ΔBCS of −0.50 and cows with ΔBCS of −0.25 were different compared with NCBCS and GBCS cows.

Data Collection

Data regarding parity at dry off (primiparous vs. multiparous), length of the dry period, length of gestation, date of calving, calf sex (female vs. male), and number of calves born (singleton vs. twins) were collected from the on-farm computer software (Dairy