ABSTRACT

The objective of this study was to compare cows housed in a freestall barn with Dual Chamber Cow Waterbeds (DCCW; Advanced Comfort Technology Inc., Sun Prairie, WI) as freestall bases to cows housed in a freestall barn with rubber-filled mattresses (MAT; Promat Inc., Woodstock, Ontario, Canada) as freestall bases. Forty-six cows were housed in the DCCW freestall barn, and 51 cows were housed in the MAT freestall barn. Milk yield was not significantly different between cows housed in the DCCW freestall barn (29.40 ± 1.02 kg/d) and the MAT freestall barn (28.61 ± 1.15 kg/d; \( P > 0.05 \)). Lying time was greater for cows housed on DCCW (10:32 ± 0:13 h/d) than for cows housed on MAT (9:47 ± 0:15 h/d; \( P < 0.01 \)). Rumination time was greater for cows housed on MAT (6:44 ± 0:08 h/d) compared with cows housed on DCCW (6:29 ± 0:08 h/d; \( P = 0.03 \)). Hock scores were lesser on cows housed in the DCCW freestall barn (1.86 ± 0.03) compared with cows housed in the MAT freestall barn (1.97 ± 0.04; \( P = 0.02 \)). The differences observed between these 2 bed types with lying times demonstrate that DCCW may benefit animal well-being compared with the MAT treatment.

Key words: waterbed, lying time, freestall, cow comfort

INTRODUCTION

One of a cow’s basic requirements is the opportunity to lie down freely (Munksgaard and Simonsen, 1996). Cows spend 50% or more of their time throughout the day lying down, as they need to rest for 12 to 14 h/d (Munksgaard and Simonsen, 1996; Jensen et al., 2005). Total daily lying time is an indicator of cow comfort (Vasseur et al., 2012), and various freestall surfaces influence lying time directly. To improve welfare, cow comfort, and productivity, housing system designs should promote increased lying times (Nishida et al., 2004).

An important criterion for any housing design is that the facilities cause minimal injuries to cattle (Ruud et al., 2010a). To minimize hock and knee lesions, a stall surface must be nonabrasive and compressible (Fulwider and Palmer, 2004). Maintaining clean cattle is also important for a housing system. Cow cleanliness is important to safeguard clean milking procedures and animal well-being (Ruud et al., 2010b). The physical environment of cattle housing is also a significant factor affecting lameness incidence (Cook and Nordlund, 2009; Ito et al., 2010) because housing on concrete has a harmful effect on claw health (Fayed, 1997; Fregonesi et al., 2009). If the lying environment does not entice cattle to lie down, a higher incidence of lameness may occur (Cook and Nordlund, 2009).

An ideal stall surface will be cost effective, sturdy, provide a comfortable lying area, keep animals clean, and minimize labor (Natzke et al., 1982). Dual Chamber Cow Waterbeds (DCCW; Advanced Comfort Technology Inc., Sun Prairie, WI) were developed in 2003 with 2 chambers (front and back). They are marketed to decrease bedding use, decrease hock lesions, and increase useful life (Fulwider et al., 2007) because they may be longer lasting and suffer less compression than rubber-filled mattresses. The objective of this study was to compare cows housed in a freestall barn with DCCW to cows housed in a freestall barn with rubber-filled mattresses (MAT; Promat Inc., Woodstock, Ontario, Canada).

MATERIALS AND METHODS

Animals and Housing

This study was conducted in 2 freestall barns at the University of Kentucky Coldstream Dairy Research Farm. The DCCW freestall barn included 54 stalls with DCCW as the stall base, and the MAT freestall barn included 54 stalls with MAT as the stall base. Access to 4 freestalls in each barn was restricted because their widths were too narrow for cows, leaving cows with access to 50 stalls in each freestall barn.

In both freestall barns, the brisket locator was a 7.62-cm schedule 40 polyvinyl chloride pipe. Stall dimensions were planned according to the MidWest Plan Service.
(MWPS, 2000) for cows over 680 kg (1,500 lb). The stall length from brisket locator to curb side of the alley was 1.8 m. The neck rail height from bottom of the rail to top of the stall base was 1.2 m. Mean stall width was 1.2 m. Each DCCW was filled with 49 L of water, with the water flowing between 2 chambers (front and back). The MAT was filled with equally sized rubber crumbs and was 2.54 cm thick. The MAT cells were then covered with a CS wax–coated single top covering for every row of stalls. Each barn area was equipped with 2 automatic waterers in the concrete lot adjacent to the barns (Figure 1). The DCCW freestall barn area contained a galvanized water tank holding 390 L and a metal water dump tank holding 284 L. The MAT freestall barn area contained a Rubbermaid (Winchester, VA) water tank holding 568 L and a metal water dump tank holding 284 L. Cows shared a raised feed bunk, 27.4 m long, 1.37 m wide, 0.30 m deep, and 0.79 m high, available to both groups of cows from opposite sides of the bunk. Cows were fed a TMR, which was balanced to meet lactating cow requirements, consisting of grain mix, corn silage, alfalfa silage, whole cottonseed, and alfalfa hay at 0600 and 1330 h daily. Each feeding area had three 3 × 6 m and four 3 × 7 m shade cloths, which blocked 80% of the sun, attached to the top of the feed bunk. Automated sprinklers (built by University of Kentucky engineers) were located below the shade cloths the entire bunk length. The sprinklers sprayed water covering an area of 2 m and were manually turned on around 21°C. Depending on the day’s temperature, the sprinklers were cycled on for 4 min and cycled off for 8 to 15 min. Eight 1.22-m 6-blade box fans (Schaeffer, Sauk Rapids, MN) and four 0.91-m 3-blade round fans (Schaeffer) hung above the stalls in both freestall barns and were manually turned on around 18°C. Cows were milked twice daily at 0430 and 1530 h. Cows were provided daily exercise in a grass lot for 1 h mid-morning. Although cows may have consumed some grass, this was not taken into consideration when balancing their ration. During this exercise time, the stalls were scraped clean once daily by hand with a rake before freestall barns were cleaned once daily with a skid steer bucket and scrape tire. New kiln-dried sawdust (8.02 ± 0.11 kg per stall) was applied on top of the stall, every other day with a skid steer bucket and scrape tire. New kiln-dried sawdust in the stall, every other day with a skid steer bucket (Wadsworth et al., 2015). Care was taken by farm staff to ensure the same amount of sawdust was applied to stalls in each freestall barn. Sawdust measurements were determined every other week with a premeasured weigh tub after stalls had been bedded in 3 predetermined stalls in each row. The premeasured weigh tub was determined before the study start; weights were recorded on the side of the tub with premeasured weights of sawdust. The predetermined stalls were selected randomly with the same positions represented in each freestall barn. Three stalls were chosen in each row and 2 stalls represented each column of stalls the length of the freestall barn (Figure 1).

Cows were balanced between freestall barns for parity, cow volume, breed, and DIM. Forty-six cows (n = 36 Holstein, n = 3 Jersey, and n = 7 crossbred) were housed in the DCCW freestall barn, and 51 cows (n = 35 Holstein, n = 7 Jersey, and n = 9 crossbred) were housed in the MAT freestall barn over the course of the study. However, stocking density never exceeded 100% in either freestall barn during the course of the study. All studies were performed with approval of the University of Kentucky Institutional Animal Care and Use Committee (IACUC protocol number: 2011–0920).

**Measurements**

**Animal Measurements.** The Milkmil Milpro P4C (Gariga di Podenzano, Italy) milking system recorded daily milk yield (MY). IceCube (IceRobotics, Edinburgh, Scotland) sensors recorded total daily lying time (LT) and lying time per bout (LB). The IceCube sensors, which were validated for dairy cattle use by Munksgaard et al. (2006), were positioned on the left rear legs and used a 3-axis accelerometer to automatically record lying time and bouts in 15-min intervals. The HR Tag (SCR Engineers Ltd., Natanya, Israel), which was validated for dairy cattle use by Schirmann et al. (2009), recorded daily rumination time (RT). These neck collars positioned the data logger onto the upper left part of the cow’s neck. The data logger contained a microphone and a microprocessor that recorded the distinct rumination sounds. Rumination time was summarized automatically into 2-h intervals. Daily cow temperature was measured using the DVM Systems LLC (Boulder, CO) bolus. The DVM bolus monitored recticularum temperature using a passive RFID transponder (Phase IV Engineering Inc., Boulder, CO) fitted with a temperature sensor queried twice daily by parlor entrance readers. All first lactation heifers were fitted with monitoring devices and boluses 2 wk before calving date. All monitoring devices and boluses stayed on or in the cow for the rest of its lactations until it was culled from the farm. If a device or bolus discontinued working during the study, it was replaced with a working one.

**SCC Measurements.** Somatic cell counts were obtained from a 90-mL composite milk sample from each cow. Somatic cell counts were analyzed using a Fossomatic FC somatic cell counter (Foss, Hilleroed, Denmark). Clinical mastitis was identified and recorded at each milking by visual assessment of milk (flakes, clots, or serous milk) and the udder (hardening, reddening, or heat). If clinical signs were displayed in the same quarter within 2 wk of the initial clinical diagnosis, the case was defined as the same clinical case.

**Hock and Hygiene Measurements.** To assess hock and hygiene conditions, pictures of each cow were collected weekly (one rear view and a profile of each side of the cow). Pictures were renumbered and scored by an observer blind to which freestall barn the cows were housed to minimize bias. Hock lesions were scored weekly using a 3-point system. Score 1 represented a cow without swelling or hair loss on both hocks. Score 2 represented a cow with hair...
دریافت فوری

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