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Sexually active groups in cattle—A novel estrus sign

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ABSTRACT

The current study presents a novel objective measure for characterizing sexually active groups (SAG 3-5) and relates this measure to other behaviors of lactating Holstein-Friesian cows. Cows in SAG 3-5 were required to participate in a minimum of 1 estrus behavior per 5 min while staying within 3 m (2 cow lengths) of its partner(s) for a minimum of 5 min. Twenty Holstein-Friesian cows were video-monitored continuously through 1 complete estrous cycle (22 d). Standing behavior, SAG 3-5, secondary estrus signs (SEC), and other social and agonistic behaviors were recorded continuously. The period of mounting estrus (MTE) was divided into the 3 parts: prestand, standing estrus (STE), and poststand. The mean durations of MTE, prestand, STE, and poststand period were 12.9 ± 1.84 , 4.0 ± 1.93 , 7.1 ± 1.44 , and 1.8 ± 0.57 h ($n = 13$). The fractions of time spent in SAG 3-5 during MTE, prestand, STE, and poststand period were 13, 8, 19, and 1% ($n = 11$). During MTE, cows participated, on average, in 5.8 ± 1.24 SAG 3-5 and initiated 9.5 ± 2.99 mounts, with mean durations of 0.25 ± 0.03 h and 4.00 ± 0.36 s, respectively. The novel measure SAG 3-5 was a sign of long duration not confined only to groups of STE cows. On one day when no cows were in estrus and during the periods 4 to 24 h before and after MTE, no SAG 3-5 behaviors were observed. Luteal-phase cows participated in SAG 3-5 only when the partner was a single cow in estrus. The time spent in SAG 3-5 increased between 1 and 3 h before MTE and the prestand period (3 vs. 8%) and reached a peak level during STE. From STE to poststand, time spent in SAG 3-5 decreased consider-

ably (19 vs. 1%). The observed decrease in nonmutual agonistic behaviors 4 to 24 h before MTE is suggested as an early sign of pre-estrus. Changes in SAG 3-5, agonistic behaviors, and SEC are suggested as indicators of the specific stages of MTE. Increased SEC initiated and SAG 3-5 were indicators of late pre-estrus and early estrus (prestand). Peak levels of SAG 3-5, SEC, and social agonistic behaviors were indicators of STE. A sudden decrease in behaviors, preceded by frequent interactions, was indicative of late estrus (poststand). On the basis of the findings reported here, we propose that SAG 3-5, as well as proceptive and receptive patterns of SEC and agonistic behaviors, be included in estrus detection protocols. Updated knowledge of these behavioral interactions may assist when determining the stage of estrus and the optimal time to breed dairy cows.

Key words: sexually active group (SAG 3-5), agonistic behavior, mounting estrus, standing estrus

INTRODUCTION

Detection of estrus is one of the major challenges in dairy cattle management. This task is challenged by the reported shortening of the estrus period and fewer cows expressing primary estrus signs over the past 30 to 50 yr (Dobson et al., 2008). Updated knowledge of estrus symptoms and reliable detection methods are essential for improving the reproductive outcome in dairy herds (Coleman, 1993; Van Vliet and van Eerdenburg, 1996). A stronger focus on other behaviors associated with estrus has been suggested to sustain and improve heat detection (Kilgour et al., 1977; Kerbrat and Disenhaus, 2004). The specific stages in mounting estrus (MTE), standing estrus (STE), and the periods before and after STE are described by Hurnik et al. (1975). However, few studies report changes in behaviors as-

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sociated with these periods. Kerbrat and Disenhaus (2004) and Sveberg et al. (2011) described social and sexual behaviors around estrus. Although reporting that changes in sexual behavior are the best indicators of the estrus period, Kerbrat and Disenhaus (2004) confirmed that mounting only occurred during estrus, in agreement with the original definitions of estrus as being the mount period (Hurnik et al., 1975). Sveberg et al. (2011) based their study on STE (true estrus) and revealed specific behavioral changes the hours before and after STE. The start and end of both STE and MTE are associated with the time of ovulation (Roelofs et al., 2005). All behavioral changes that can identify specific stages in estrus; that is, start and end of MTE and start and end of STE, should be identified and described, as mounting and standing behaviors are often absent in estrous cows (Van Vliet and van Eerdenburg, 1996; Orihuela, 2000). Identifying signs and understanding behavioral patterns associated with specific stages of estrus may improve estrus detection and decisions about the most appropriate time to breed dairy cattle.

Sexual activity is traditionally recorded as single events. Primary and secondary estrus signs are of short duration (Hurnik, 1987) and might be difficult to use in heat detection (Dobson et al., 2008). Other social behaviors are known to be associated with estrus (Kerbrat and Disenhaus, 2004; Sveberg et al., 2011) and to influence the manifestation and detection of estrus (Hafez and Lindsay, 1965; Galina et al., 1996). Intense female–female interactions, expressed by estrous cows staying close to each other in sexually active groups (**SAG**), are described in the literature as characteristic of cattle as a species (Hafez and Bouissou, 1975; Albright and Arave, 1997). This tendency of estrous cows to approach and remain in the vicinity of other cows, even when other signs of estrus are not expressed, is probably known among farmers. Despite this, information on how these interactions can be used in estrus detection is not commonly available in the scientific literature.

To our knowledge, all previous studies identified SAG by recording groups of cows participating in mounting or standing to be mounted (Kilgour et al., 1977; Ramírez-Iglesia et al., 2006; Law et al., 2009). Ramírez-Iglesia et al. (2006) suggested that the detection of SAG could contribute to improving the efficiency of estrus detection in cattle. The longer durations of SAG reported in their study imply that SAG could be easier to discover than single estrus signs of reported short durations (Hurnik et al., 1975).

To our knowledge, no reports define and quantify SAG, other than those based on the number of cows in STE. A previous report (Sveberg et al. 2011), describ-

ing behaviors through a complete estrous cycle by continuous video surveillance, revealed that estrous cows tended to stand close to other cows while performing mutual estrus behavior. The objective of the present study was to develop measures to describe the SAG in a qualitative and quantitative manner and to relate these measures to other behaviors through complete estrous cycles of lactating Holstein-Friesian cows.

MATERIALS AND METHODS

All procedures were carried out under experimental license issued by the Irish Department of Health and Children, in accordance with the European Communities (Amendment of Cruelty to Animals Act 1876) Regulations 2005.

Animals, Housing, and Management

Twenty Holstein-Friesian cows were housed on an outdoor pad from April 11 to May 16, 2006, at the Teagasc Moorepark Ballydague research farm in Ireland. The study duration was 22 d, beginning on April 18. The pad was 17 × 24 m, with wood chip flooring (O'Driscoll et al., 2008). Cows were offered freshly harvested grass *ad libitum* twice daily, 2.6 kg of concentrate DM per cow in the milking parlor, and unlimited access to fresh water. Cows were in first to sixth parity, with a frequency distribution of 8, 3, 2, 4, 2, and 1, respectively. Cows included in the study were required to be at least 5 wk postpartum, to have no abnormal signs in the reproductive tract upon examination by ultrasound, lameness scores of ≤ 2 (Sprecher et al., 1997), and BCS of at least 2.5 (Lowman et al., 1976).

The cows were milked twice daily (0700 and 1530 h), using a parallel milking stall with 2 × 20 milking places. Individual cow milk yield was recorded using electronic milk meters (Dairymaster, Causeway, Co. Kerry, Ireland). Reproductive organs were examined by ultrasound (Aloka SSD-500, Tokyo, Japan), equipped with a 5-MHz rectal transducer, between d 28 and 35 and d 50 and 60 postpartum to reveal reproductive disorders and evidence for ovarian cyclicity. Body condition score was scored monthly postpartum and 14 d before the start of the study. Body weights were recorded weekly.

Ovarian Function

Daily whole milk samples were drawn from each cow to measure progesterone concentrations. A potassium dichromate preservative tablet (Lactab Mark III, Thompson & Capper Ltd., Cheshire, UK) was immediately added to daily samples, which were then cooled,

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