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Comparison of Holstein-Friesian and Norwegian Red dairy cattle for estrus length and estrous signs

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ABSTRACT

This study addressed the effect of breed on estrus length and estrous behavior by observing 20 Holstein-Friesian (HF) and 20 Norwegian Red (NRF) cows on an outdoor wood-chip pad through 1 estrous cycle (22 d). Detailed behavioral data were collected by continuous (24 h) video monitoring of all cows. Accurate estimation of duration of estrous periods, behavioral signs (sum per period and counts per hour), and duration and number of sexually active groups were reported through all stages of mount estrus (prestand, standing estrus, and poststand). These dependent variables were analyzed with a basic statistical model that included fixed effects for breed and lactation group. Other independent variables (milk yield, body condition score, and number of cows in standing estrus) were added to the basic model one by one and included in an expanded model if they had an effect on the respective dependent variables. Estrus duration was considerably shorter in HF compared with NRF cows for all the major periods: mount estrus $(11.2 \pm 3.0 \text{ vs. } 21.3 \pm 2.7 \text{ s})$ h), standing estrus $(7.1 \pm 1.4 \text{ vs. } 11.7 \pm 1.3 \text{ h})$, mounting period (6.9 \pm 2.7 vs. 18.2 \pm 2.4 h), and mounted period $(9.2 \pm 2.8 \text{ vs. } 17.5 \pm 2.6 \text{ h})$. Additionally, the NRF cows spent more time in sexually active groups $(36.1 \pm 4.0 \text{ vs. } 17.6 \pm 4.8\%)$ during standing estrus compared with HF cows. The NRF cows participated in a greater number of sexually active groups (9.6 ± 1.3) vs. 5.5 ± 1.3) with longer average duration (0.42 ± 0.04) vs. 0.20 ± 0.04 h) and continued to be more active in these groups through late stages of estrus (poststand)

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compared with the HF breed. Mounting activity differed between breeds as NRF mounted more times in total $(46.3 \pm 6.2 \text{ vs. } 18.1 \pm 6.3)$ and per hour (2.6 ± 0.4) vs. 1.5 ± 0.5) during mount estrus. In addition, NRF tended to express the primary estrous sign, standing when mounted, more often during standing estrus (32.4 \pm 5.0 vs. 18.5 \pm 5.2). The HF initiated more unsuccessful mounts $(1.6 \pm 0.3 \text{ vs. } 0.6 \pm 0.3)$ per hour than did NRF during mount estrus. A significant effect of milk yield was demonstrated only on this behavior. For other estrous signs, HF cows initiated chase-up (2.0 \pm $0.5 \text{ vs.} 0.5 \pm 0.4$) and an equivalent shift $(3.7 \pm 0.6 \text{ vs.} 2.0 \text{ sc})$ ± 0.5) more frequently (counts per hour), whereas NRF expressed more total head butt behavior $(32.3 \pm 4.7 \text{ vs.})$ 14.2 ± 4.8) during mount estrus. Body condition score had a significant effect on receptive behavior. Measures of estrus duration, sexually active group activity, and behavior related to estrus should be subjected to larger studies for improved heat detection and possible implementation in breeding programs.

Key words: estrous length, breed, fertility

INTRODUCTION

Impaired health and fertility are major obstacles for efficient management, and failure to detect estrus is regarded as one of the most important factors contributing to reproductive failure in dairy herds (Senger, 1994; Van Vliet and van Eerdenburg, 1996). Animal behaviorists report significant side effects on behavior and welfare, which is thought to be due in part to the several decades of intense selection for increased milk production (Jensen et al., 2008; Boichard and Brochard, 2012). Breeding programs focusing on milk yield have resulted in substantially increased milk yield and reduced fertility of the predominant dairy breed,

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Holstein Friesian (**HF**), over the last 40 yr (Dobson et al., 2008; Walsh et al., 2008). Milk yield is reported to influence estrous behavior (Lopez et al., 2004; Cutullic et al., 2012), and breed effects on production and fertility traits are described in the literature (Walsh et al., 2008). The influence of breed on estrous expression, however, is poorly documented.

For dairy breeds such as Norwegian Red (**NRF**) and Swedish Red cattle, fertility traits have been included in the breeding programs for the last 40 yr (Refsdal 2007), with documented and sustained fertility despite increasing milk yield (Philipsson and Lindhé, 2003). Estrous expression in Scandinavian Red cows, however, is not well documented in the literature. Most knowledge has relied on the many studies reporting behavioral signs in HF cows (Van Vliet and van Eerdenburg, 1996; Kerbrat and Disenhaus, 2004). Hammond (1927), Trimberger (1948), and Hurnik et al. (1975) found no differences in estrous expression between breeds, but few recent studies address these questions (Cutullic et al., 2009), and several of them compare beef breeds (Rae et al., 1999; Landaeta-Hernández et al., 2004).

Mounting behaviors are frequently used in visual observation, they are required for different heat detection devices such as tail paint and automatic mount detectors, and they represent proceptive and receptive patterns that characterize specific periods in estrus (Sveberg et al., 2011). Over the past 30 to 50 yr, the percentage of animals in estrus that stand to be mounted has declined from 80 to 50%, and the duration of standing estrus has declined from 15 to 5 h, according to a review of different studies by Dobson et al. (2008). The same authors report that the duration of total number of estrous signs has not declined in the same period, suggesting a change from primary to other estrous signs in the HF breed. The use of concrete as flooring impairs mount activity, stand activity, and estrus duration (Britt et al., 1986), and an increase in diseases such as lameness is reported to decrease intensity of estrous signs (Dobson et al., 2008). A greater number of cows express mount estrus than standing estrus (Hurnik et al., 1975; Sveberg et al., 2011); consequently, more focus on the mount period would be preferable. Nevertheless, few other studies are based on continuous observations through complete estrous cycles (Rodtian et al., 1996), reporting detailed data of behaviors and duration of specific estrous periods (Hurnik et al., 1975).

Løvendahl and Chagunda (2009) and Løvendahl et al. (2009) report higher heritability for estrus activity traits and days to first estrus compared with traditional fertility traits and discuss the possibility of including estrous expression in future breeding programs. Public perception and opposition may demand less use of hormonal synchronization protocols in future dairy management. Consequently, knowledge of estrous expression and possible breed differences may prove increasingly important in contemporary dairy production.

The objective of the present study was to determine the effect of breed on estrus length and estrous signs by observing 20 HF and 20 NRF cows continuously through 1 complete estrous cycle.

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 from the study of Sveberg et al. (2011) and 20 Norwegian Red cows, all at the Teagasc Moorepark Ballydague research farm in Ireland, were observed continuously for 22 d, beginning on April 18, 2006. The 2 groups of cows were each housed on a 16- \times 24-m outdoor pad with wood-chip flooring. The groups were separated by a 2-m-wide corridor, and electrical fences were used to prevent physical contact. Halfway through the study, the groups changed location so that the 2 groups were housed on both paddocks. The cows were offered freshly cut pasture and 2.6 kg of concentrate DM per cow per day (Sveberg et al., 2011). Cows were in first to sixth parity, with a frequency distribution by parity of 8, 3, 2, 4, 2, 1 and 8, 4, 1, 4, 0, 3 for HF and NRF, respectively. Body condition score (Lowman et al., 1976) was recorded monthly postpartum and 14 d before the start of the study. Body weights were recorded weekly. Cows included in the study were required to have no abnormal signs in the reproductive tract upon examination by ultrasound, lameness scores of ≤ 2 (Sprecher et al., 1997), BCS of at least 2.5 (Lowman et al., 1976), and be at least 5 wk postpartum (mean 63 d; range 44 to 84 d for HF and mean 65 d; range 42 to 85 d for NRF). Reproductive organs were examined by ultrasound (Sveberg et al., 2011) between d 28 and 35, and between d 50 and 60 postpartum to reveal reproductive disorders and evidence of ovarian cyclicity. Individual cow milk yields were recorded using electronic milk meters (Dairymaster, Causeway, Co. Kerry, Ireland) and twice-daily milk samples from each cow were preserved and frozen for later measurements of progesterone concentration by enzyme immunoassay (Waldmann, 1993), modified by using the second antibody coating technique (Waldmann, 1999; Sveberg et al., 2011). Function of the corpus luteum was confirmed Download English Version:

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