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Short communication

Influence of an early exposure to the calving pen on lying behavior at calving and avoidance distance of dairy heifers

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ABSTRACT

Dairy heifers are confronted with a number of changes in their environment before their first parturition. In this study, we examined the influence of an early exposure to a calving pen 4 weeks prepartum, combined with increased human–animal contact, on behavior around calving and avoidance distance of heifers. Data were collected on 65 Brown Swiss heifers on five Swiss dairy farms. On each farm heifers were randomly assigned to two treatment groups. Thirty-four treated heifers were singly housed for 24 h in the calving pen 4 weeks before expected calving, a procedure that also involved handling by a human. Heifers of the control group ($n=31$) were housed for the first time in the calving pen on the days before and during parturition. Lying behavior was recorded using data loggers, and a human avoidance test involving a familiar and an unfamiliar person was conducted 4 weeks prepartum and 1 week postpartum. Additionally, interventions during parturition were logged. Neither the proportion of time spent lying observed for either 48 or 12 h around birth nor the number of lying bouts observed for 48 around birth differed significantly between treated and control heifers (all $P > 0.20$). In the period of 6 h before to 6 h after calving, the number of lying bouts decreased with number of days that heifers had spent in the calving pen before parturition for the treated heifers and increased for the control heifers (interaction $P=0.019$). The avoidance distance was higher for the unfamiliar than for the familiar person ($P < 0.001$), tended to decrease from before to after calving ($P=0.07$), and did not differ between treated and control heifers ($P=0.14$). There was no significant difference in the risk of an intervention between treated and control heifers ($P=0.24$). In conclusion, these results do not provide evidence that an early exposure of dairy heifers to the calving pen had a positive effect on their lying behavior around parturition and avoidance distance. However, additional time in the calving pen pre-partum seemed to have a calming effect as reflected by the number of lying bouts in the treated but not the control heifers.

1. Introduction

Prior to first calving, heifers are exposed to various changes in their housing conditions. In an attempt to enhance the animals' ability to cope with these changes, previous studies have investigated the effects of different methods of introducing heifers to the dairy herd on heifer behavior and performance. Gygax et al. (2009) reported that introducing heifers in pairs rather than singly is advantageous whereas Boyle et al. (2012) recommended to introduce heifers into the herd after the evening rather than the morning milking. Wicks et al. (2004) took heifers through the parlor without milking in the prepartum period and found that this training increased the duration of milking and milk yield. Similarly, it could be expected that heifers are calmer during calving if they have been previously exposed to the calving pen. In addition, it is assumed that calmness increases welfare around birth (Jensen, 2012), may ease the birth process and therefore lead to fewer human interventions during birth.

In the present study, we introduced heifers to a calving pen for a 24 h period 4 weeks before expected calving to habituate them to the calving environment. We chose the time point 4 weeks prepartum as being as close in time as possible to the period when heifers were put into the calving pen for calving while, at the same time, clearly separating the training from the calving period. We chose one 24 h period of training exposure to the calving pen because we wanted to keep the effort manageable in respect to farming practices neither over-occupying the calving pens nor overtaxing the effort needed for interacting with the heifers during pre-exposure. We expected that treated heifers, compared with control heifers not experiencing early exposure to the calving pen, would be less restless during parturition, resulting in increased duration of lying behavior and fewer lying bouts, and be

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less subjected to human intervention to deliver the calf. As habituation to the calving pen was associated with increased gentle human–animal contact, we also expected a larger reduction in the human avoidance distance in the treated compared with the control heifers when comparing avoidance tests carried out before the treatment and postpartum. The number of days that heifers spent in the calving pen before parturition could lead to additional habituation and was therefore considered as a nuisance variable in the analyses.

2. Materials and methods

2.1. Animals, farms, and experimental design

The study was conducted on five farms in Switzerland between May 2011 and July 2012. On all farms, cows were housed in cubicle housing systems and had access to pasture in the summer. Average herd size was 57 lactating cows (range: 36–70). Herd composition was 85% Brown Swiss and 15% Holstein Friesian across all farms. In total, 65 Brown Swiss heifers (10–21 per farm) were recruited with an average first calving age of 28 month ($\pm$ 3SD, range: 23–38). Heifers on each farm were randomly assigned to two treatment groups. In the control group, 31 heifers (4–12 per farm) were brought singly to the calving pen before the calving on each farm (in the median 10, range 1–30 days before calving). In the treatment group, 34 heifers (5–9 per farm) were brought to the calving pen for 24 h about 4 weeks before expected calving by a familiar stockperson to allow a habituation to this housing condition (in the median 29, range 3–47 days before actual calving). After the 24 h, the heifers were brought back to the herd and remained there until before calving (in the median until 6, range 1–31 days before calving). The habituation to the calving pen also involved handling of the heifers by the stockperson when driving them to the pen as well as human–animal contact in the pen. Heifers were quietly brought to the calving pen using a calm voice and no driving aids and were then left to settle down. The familiar stockperson was instructed to go to the calving pen for ten minutes, three times during the 24 h of habituation, approach the animal slowly and without force while talking calmly. If this was possible the stockperson was instructed to stroke the heifer at the side of the neck or at the lower part of the neck in case heifers would lift their head to expose that part. This human–animal contact was considered an integral part of the treatment. All animal experimentation procedures had been approved by the Cantonal Veterinary Authority (Canton Thurgau permit no. F4/10).

2.2. Measurements

The human–animal relationship was assessed based on a human avoidance distance test. The test was conducted in the herd and animals were approached only when they were standing and at a speed of one step per second starting from a distance of 4 m (Waiblinger et al., 2003; Windschnurer et al., 2008). The test was conducted when the heifers had already been introduced to the dairy herd 4 weeks before expected calving and repeated 1 week postpartum. At each testing the avoidance distance towards the familiar stockperson (one stockperson per farm) and towards an unfamiliar person (TK or AB) was determined in this sequence with at least 5 min between the two tests. The avoidance distance was estimated in m as the distance between the person's hand and the animal's muzzle when the animal started to move away or turned its head aside. TK and AB together trained conducting the avoidance test and equilibrated their distance estimates. Stockpeople were carefully instructed on how to conduct the avoidance distance test.

Lying behavior in the calving pen was automatically determined based on the data of a commercial 3D acceleration logger (MSR145, dimensions $39 \times 23 \times 72$ mm^3, weight approximately 64 g; MSR Electronics GmbH, Seuzach, Switzerland) that was fitted below the hock of the right hind leg with Velcro tape and protected with an elastic self-adhesive bandage (Equilastic, 200×10 cm^2, Albert Kerbl GmbH, Buchbach, Germany). The logger was fitted when the heifers were fixated in the feed rack after having conducted the avoidance distance test and before leading the heifers to the calving pen, respectively. No behavioral reactions toward the fitting of the logger was observed. Acceleration values parallel to the hind leg were recorded every 30 s. These values were expected to reach approximately -1 g while heifers were standing and zero when they were lying. Two consecutive measurements with identical information (larger or smaller than -0.5) were needed to define a switch between standing and lying. Lying duration as well as the number of lying bouts was measured from 24 h before until 24 h after the point in time when the calve was born. Lying behavior was analyzed for a time window of 12 h (6 h before–6 h after birth) as well as for the whole observation period of 48 h covering a very similar time period as in Jensen (2012).

In 21 of the 65 calvings, an intervention was scored. These interventions consisted of 16 events where the birth process was eased by slight pulling, two difficult calvings (dystocia), two stillbirths with human intervention (both in control heifers), and one case where birth was induced. In the cases of dystocia and calving induction a veterinarian was present. All other events took place under surveillance of the stockpeople only.

2.3. Statistics

We applied generalized linear mixed-effects models in R 3.0.1 (R Core Team, 2013) using package lme4 (Bates et al., 2013). To satisfy assumptions, which were checked using a graphical analysis of residuals, the avoidance distance (in m) and the number of lying periods were log transformed, the proportion of time spent lying per 12 h and 48 h was logit transformed, and the risk of an intervention during calving was evaluated using a dichotomized outcome variable and the binomial distribution. In the model on the avoidance distance, calendar date nested in individual identity nested in farm was used as the random effect. In all other models, farm was the sole random effect. We conducted step-wise backwards model selection based on the likelihood-ratio test. The maximum model from which we started included the treatment group (factor with two levels: treated versus control). To control for habituation effects of the time spent in the calving pen pre-partum, the number of days heifers had spent in the calving pen pre-partum (continuous) and its interaction with treatment group were additionally included as fixed effects. The analysis of the risk of an intervention during calving also included age at calving as a possible confounder (continuous) plus all possible interactions. The analysis of the avoidance distance included the additional predictors time-point (factor with two levels: before versus after calving) and degree of familiarity of the approaching person (factor with two levels: unfamiliar versus familiar) plus all possible interactions.

3. Results and discussion

Results showed that human avoidance distance did not differ significantly between the treated and the control animals (on average avoidance distance was longer by 51% in treated than control heifers; $\chi^2 = 2.21$, df $= 1$, $P = 0.14$), did not vary with number of days spent in the calving pen pre-partum (on average avoidance