



## The effect of age at separation from the dam and presence of social companions on play behavior and weight gain in dairy calves

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### ABSTRACT

Play behavior positively affects welfare of farm animals, yet impoverished social environment during early ontogeny may limit the opportunity or motivation to play. This study investigated the independent and the combined effects of the presence of the dam during the colostrum feeding period and subsequent group housing on play behavior and growth in dairy calves. Forty female calves were allocated to 1 of 4 treatments according to a 2 × 2 factorial design. The treatments were with or without mother during the 4 d after birth and companion housing (single pens or grouped housing in pens of 4 calves between 1 and 8 wk of age). After 8 wk of age all calves were housed in groups of 4 calves. Play behavior of the calves was observed at 2, 5, and 12 wk of age in the following situations: 6 h of spontaneous behavior in the home pen, a 15-min open-field test, and a 15-min social test with an unfamiliar calf. Additionally, play behavior after grouping or relocation at 8 wk of age was recorded during two 2-h sessions. There were no significant effects of the mother by companion interaction either on the amount of play behavior in any of the tests or on the body weights of the calves. Presence of the mother after birth did not increase later playfulness, with the exception of higher spontaneous play at 12 wk of age. When calves were housed in groups of 4, they played more in the home pen on wk 2 and 5 than individually housed calves of the same age. In contrast, individually housed calves were more playful during open-field tests and social tests on wk 2 and 5. At 8 wk, single calves that were placed in a new pen with 3 unfamiliar calves played more than twice as much as grouped calves that were just moved to a new pen with familiar companions. These results show that single-housed calves are deprived of natural levels of play, as demonstrated by both their lower spontane-

ous play behavior and the higher rebound effect when they are exposed to larger spaces or larger spaces plus companions. Calves that stayed with their mothers for 4 d postpartum grew much better until the end of the second week. After that, grouped calves grew better until wk 10 and they tended to be heavier for at least 2 wk after relocation or mixing at wk 8. The study shows that brief maternal rearing and group housing independently improve different aspects of performance and welfare of dairy calves.

**Key words:** calf, play behavior, ontogeny, welfare, housing

### INTRODUCTION

Under natural conditions, young calves live in a complex social environment. Immediately after birth, the cow is the calf's first social partner. Later on, the calf gradually spends more time associating with peers and other cows (Edwards and Broom, 1982; Le Neindre and Sourd, 1984). In contrast, on most dairy farms young calves are separated from their mothers a few hours after birth and then housed in individual pens until 6 to 8 wk of age. Both the deprivation of maternal care through early separation and the isolation from peers through individual housing may compromise the welfare of the calf. Attempts have been performed to partially restore the natural social environment through postponing the separation from the mother for a few days and housing calves in groups from the second week of life. One approach to measure whether these modifications improve welfare is to record play behavior of the calves. Play behavior may be a good indicator of welfare in young mammals (Held and Špinka, 2011) because its frequency decreases under unfavorable conditions (Bekoff, 1972; Dannemann et al., 1985; Jensen et al., 1998; Špinka et al., 2001; Rushen and de Passillé, 2012). For example, play decreases when the intensity of light is insufficient (Dannemann et al., 1985), when food provisioning drops (Krachun et al., 2010; Duve et al., 2012), or when calves are subjected to painful procedures such as hot-iron disbudding (Mintline et

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al., 2013). Housing calves in group pens with sufficient space allowance has been reported to increase play behavior (Jensen et al., 1998; Jensen and Kyhn, 2000; Duve and Jensen, 2012). Stěhulová et al. (2008) looked at the effect of brief dam-rearing on later calf play behavior and found increased social play in 1 of their 2 dam-rearing treatments.

Both staying with the mother or group housing can also enhance calf BW (Warnick et al., 1977; Flower and Weary, 2001; Tapki, 2007; Babu et al., 2009), although some studies failed to find this effect (Hänninen et al., 2003; Phillips, 2004). Also, it remains unclear for how long the weight advantage of mother-reared or group-housed calves lasts. The effect of maternal presence may be negated very quickly when the calves are separated from the mothers at, for example, 4 d, as the separation may lead to weight loss.

Thus, evidence exists that both brief maternal rearing and group housing may improve welfare and enhance growth in dairy calves. However, it has never been investigated whether an interaction between these 2 enrichments of the social environment exists. It is possible that if calves are provided with both components of the natural social environment, their growth potential and welfare status will be particularly positively affected. Therefore, our study investigated the independent and the combined effects of the presence of the dam during the colostrum-feeding period and subsequent group housing on play behavior and growth in dairy calves.

## MATERIALS AND METHODS

### *Animals and Housing*

The observations were carried out at the experimental farm of Institute of Animal Science in Prague (Czech Republic). The calves were kept with their mothers in a straw-bedded calving pen (4 × 3 m) until separation. After separation from mother they were fed 2 L of milk (or colostrum before 5 d of age) twice a day from open buckets until 8 wk of age. Calves had ad libitum access to hay, starter mixture, and water during the entire rearing period.

### *Experimental Design and Procedures*

The study was designed and performed in accordance with European and Czech laws. The protocol was approved by the Institutional Animal Care and Use Committee of the Institute of Animal Science.

In the study, 40 experimental heifer calves (11 Czech Red Spotted and 29 Holstein) were randomly allocated, at the time of their birth, to 1 of 4 treatments ac-

ording to a 2-factorial design. The first treatment (**MTHR**) differentiated between calves kept with and without their mother during the first 4 d. After the separation from mother until 1 wk of age, all the calves were housed individually to ensure that they knew how to drink milk from an open bucket. Thereafter, the companion treatment (**COMP**) was imposed that distinguished between calves reared with 3 social companions (**GRP**) and calves reared in individual pens (**SNGL**) between 1 and 8 wk of age. The SNGL calves remained in the same particular individual pen from separation until grouping at 8 wk and the GRP calves remained in the same group pen between wk 1 and 8. The individual pen consisted of an individual plastic hut (1.2 × 1.4 m, 1.7 m<sup>2</sup>) and an outside run (1 × 1.2 m, 1.2 m<sup>2</sup>). The calves in individual pens had visual but not tactile contact with 2 other calves in neighboring pens, as a gap of 40 cm was present between the pens. The group pen consisted of 4 individual plastic huts (4 × 1.7 m<sup>2</sup>) connected by the central outside run (4 × 1.2 m<sup>2</sup>). All huts had solid floor, richly bedded with straw (4 kg/calf, cleaned and added 3 times per week). The outside run had solid floor that was cleaned once a week. In the GRP treatment, 2 heifer calves and 2 bull calves of similar age were housed together in each of 20 groups, but only 1 heifer per group was followed as the experimental animal. Thus, there were 40 experimental animals, or 10 experimental animals per each treatment combination. Because of the limited herd size, 2 to 3 heifers were entering the experiment in a month according to the current number of calvings at the farm. The order of assignment of calves to the 4 treatments was randomized. The breed of the calves could not be fully randomized across the treatments because we could not influence in which order the calves of the 2 breeds and of the 2 sexes would be born. The COMP treatment was moderately balanced for breed at the beginning of the experiment (Holstein-to-Czech Red Spotted ratio was 16:4 in the SNGL treatment and 13:7 in the COMP treatment) and nearly balanced at 12 wk (14:4 SNGL, 12:4 COMP). However, the MTHR treatment was not balanced in terms of breed either at the start (the breed ratio being 17:3 among calves separated from mother immediately and 12:8 among calves kept with mothers) or at the end of the experiment at 12 wk (the breed ratios being 15:1 and 11:7, respectively). Therefore, we controlled for the effect of breed by including it as a fixed factor in the statistical models. There was no difference in birth weight between calves allocated to the 4 treatments ( $F_{3,36} = 0.77$ ;  $P = 0.518$ ).

At 8 wk of age, calves from the SNGL treatment were grouped with 3 unfamiliar calves (1 heifer and 2 bull calves). Calves in the GRP treatment were moved to a

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