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Effects of level of social contact on dairy calf behavior and health

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ABSTRACT

Housing preweaned dairy calves in pairs rather than individually has been found to positively affect behavioral responses in novel social and environmental situations, but concerns have been raised that close contact among very young animals may impair their health. In previous studies, the level of social contact permitted in individual housing has been auditory, visual, or physical contact. It is unclear how these various levels of social contact compare with each other and to pair housing, when their effects on behavior and health are considered, and whether the timing of pair housing has an effect. To investigate this, 110 Holstein calves (50 males, 60 females) in 11 blocks were paired according to birth date. Within 60 h of birth, each pair of calves was allocated to 1 of 5 treatments: individual housing with auditory contact (I), individual housing with auditory and visual contact (V), individual housing with auditory, visual, and tactile contact (T), pair housing (P), or individual housing with auditory and visual contact the first 2 wk followed by pair housing (VP). At 6 wk of age, calves were subjected to a social test and a novel environment test. In the social test, all pair-housed calves (P and VP) had a shorter latency to sniff an unfamiliar calf than did individually housed calves (I, V, and T), whereas calves with physical contact (T, P, and VP) sniffed the unfamiliar calf for longer than calves on the remaining treatments (I and V). In the novel environment test, calves with physical contact (T, P, and VP) had a lower heart rate, and more of these calves vocalized during the test compared with calves without physical contact (I and V). No effect of treatment was found for clinical scores, levels of the 5 most common pathogens in feces, or in development of serum antibodies against the 3 most common respiratory pathogens. Calves housed individually are more fearful of unfamiliar calves than are pair-housed calves. Contrary to common belief, the allowance of physical

contact and pair housing had no effects on the health of the calves.

Key words: behavior, health, social, animal welfare

INTRODUCTION

Providing social contact to preweaned dairy calves by housing them in pairs or small groups rather than individually positively affects their behavior. Pair-housed calves approach and sniff another calf more readily than individually housed calves, whereas individually housed calves forcefully push other calves once social interaction is initiated (Duve and Jensen, 2011; De Paula Vieira et al., 2012). This indicates less ability to regulate social interactions among individually housed calves and is likely due to limited social experience. In novel environments, individually housed calves respond more fearfully, involving an elevated heart rate (Jensen et al., 1997). Furthermore, the inability to perform social behaviors may be the cause of abnormal behavior such as excessive licking of their own bodies and fixtures seen in individually housed calves (Bokkers and Koene, 2001). Finally, social housing of preweaned calves has resulted in higher intakes of concentrate (De Paula Vieira et al., 2010) and hay (Hepola et al., 2006) compared with calves in individual housing. However, individual housing may vary in regard to the level of social contact possible. In some types of individual housing, tactile contact between neighboring calves is possible, whereas in others, calves can see but not touch each other. In some cases, when calves are housed in closed individual pens or hutches with no calves placed opposite, they merely have auditory contact with conspecifics. The first aim of the study was to investigate the effect of level of social contact on calf behavior. We hypothesize that a higher level of social contact would result in a lower fear response to novel environments and unfamiliar calves, a lower level of abnormal behavior in the home environment, and a higher intake of concentrate. Under semi-natural conditions, calves stayed in the proximity of their dams for the first weeks of life (Lidfors and Jensen, 1988), whereas under production conditions, stronger bonds were formed among calves that were paired at birth rather than later (Duve

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and Jensen 2011). Therefore, an additional social treatment, where calves were pair-housed from the age of 2 wk, was included to investigate whether postponing pair housing until this age affected the aforementioned behavioral responses.

Normal development of behavior is one concern for animal welfare, and animal health is another. It may make sense to limit the level of social contact among calves to limit direct horizontal transmission of pathogens. In support of this, Gulliksen et al. (2009) found a higher mortality for calves housed in groups before the age of 1 mo compared with individually housed calves; moreover, calves that had been individually housed preweaning had a lower risk of respiratory disease after weaning compared with calves that had been housed in groups (Svensson et al., 2006). On the other hand, Svensson et al. (2003) showed that preweaned calves housed in small groups had a lower incidence of respiratory disease than calves housed in large groups or in individual pens, suggesting that the adverse effects of group housing on health is a question of group size rather than of social contact per se. Few studies have compared health among calves with varying levels of contact in individual pens or in pair housing, and thus evidence is scarce as regards the health effects of avoiding tactile contact between calves. The second aim of the present study was to investigate the effect of the level and timing of social contact on calf health.

MATERIALS AND METHODS

The study was conducted at the Aarhus University research facilities (Foulum, Denmark). Calves were housed and managed according to a protocol approved by the Danish Animal Experiments Inspectorate, Ministry of Justice, Copenhagen, Denmark (reference number 2010/561-1780).

Animals, Feeding, and Management

One hundred ten Danish Holstein dairy calves (50 male and 60 female) in 11 blocks were paired according to birth date. All calves were born in individual calving pens and separated from their dams between 2 and 6 h after birth. If the youngest calf of a pair was born within 6 h of the oldest calf of the pair, then the 2 calves were moved directly from their calving pen to the experimental pens placed in an adjacent building. If the youngest calf of a pair was not born within 6 h of the birth of the oldest, then the oldest calf was placed in a clean straw-bedded individual calf pen placed in a room adjacent to the calving facility until the youngest calf was born, accepting an age difference within a pair of maximum 60 h. The 2 calves were moved together to

the experimental building within 2 to 6 h of the birth of the youngest calf. The birth weight of the calves was 43 ± 5.9 kg (mean \pm SD).

Calves were fed milk twice daily at 0600 and 1600 h, and the calves were always fed in the same order. Calves were offered 4 L of colostrum within 6 h of birth. Until the youngest calf of a pair was 4 d old, both calves of a pair were offered 6 L of colostrum per day given in 2 daily feedings of 3 L. The colostrum was preferably from the dam, but was supplemented from a colostrum pool if the dam's quality did not meet minimum standards (≥ 50 mg of IgG/mL). From d 4 until the end of the experimental period, calves were fed 6 L of whole milk per day in 2 daily feedings of 3 L. All milk feedings were offered in teat buckets (plastic buckets fitted with one teat; Peach Teat, Skellerup Industries Ltd., Christchurch, New Zealand). All buckets were individually marked and cleaned between feedings, and each calf was always offered milk from the same bucket. Concentrates (18% CP, 4% fat, and 6% fiber; Grøn Kalv Valset; DLG, Copenhagen, Denmark), hay, and water were offered ad libitum throughout the study.

Experimental Treatments and Design

Within each block, pairs of calves were allocated in a random order to 1 of 5 treatments: individual housing with auditory contact (**I**), individual housing with auditory and visual contact (**V**), individual housing with auditory, visual, and tactile contact (**T**), pair housing (**P**), or auditory and visual contact the first 2 wk followed by pair housing (**VP**). Pair housing at 2 wk of age (**VP**) was included to investigate if pair housing within 3 d of birth (**P**) differed from pair housing at 2 wk of age.

All pens had sides made from vertical tubular metal bars (bar diameter: 2.5 cm; distance between bars: 10 cm). Pens of calves of different treatments were positioned 1.5 m apart, ensuring that calves did not have physical contact with calves on other treatments. Thus, pair-housed calves (**P**) had full social contact with only their pair partner but had visual contact with other calves in the building. Calves housed individually with visual and tactile contact (**T**) were housed in adjacent pens and could have physical contact with their pair partner through the bars of the separating pen side and visual contact with other calves in the building. Calves housed individually with visual contact (**V**) were housed in adjacent pens positioned 1.5 m apart, allowing visual contact with the pair partner as well as other calves in the building. However, the sides of isolation pens (**I**) were covered with plywood, which also covered the feeding area, and thus prevented all social contact with other calves except auditory contact with

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