



The formation of preferential relationships at early age in cattle

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ABSTRACT

Calves can develop long-lasting social relationships with peers. We examined the strength of the relationships between calves according to the time they had been together. Twenty-four female dairy calves were assigned to six groups of four animals (Type-1 partners) at 0.5 month of age. At 3.5 months of age, they were mixed with other calves (Type-2 partners) to form groups of 14. Type-3 partners were calves added to the experimental groups after 5.25 months. The calves stayed together until 1.5 years of age. Social preferences between the three partner types were examined in a Y-maze, and the position and activity of animals in the barn and pasture were followed in three periods. Behavioural synchrony, distance between animals, proximity and nearest neighbour were analysed. The calves more frequently butted Type-3 than Type-1 partners in the Y-maze ($P < 0.05$). They spent more time in proximity to Type-1 partners, and these were more often the nearest neighbours than other partners ($P < 0.001$). Synchrony and distance between animals were greater at pasture than in the barn ($P < 0.01$). Calves seem to form preferential relationships before 3.5 months of age. Keeping cattle together from an early age seems beneficial for them.

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1. Introduction

Trade of calves, heifers and cows between farms is part of the dairy business. Animals may therefore experience farm changes and several group changes, i.e. regroupings, during their lives.

Sub-adult and adult cattle typically display aggression for some hours after regrouping (for heifers, see Hasegawa et al., 1997; Phillips and Rind, 2001; Raussi et al., 2005; Neisen et al., 2009; for cows, see von Keyserlingk et al., 2008). Aggressions occur even after many regroupings; thus, the animals seem not to habituate to regroupings (Raussi et al., 2005). Aggressions after regrouping or several regroupings are not as frequent in calves under the age of 5 months (Veissier et al., 2001).

Calves that have been together since birth have stronger social bonds, measured by their nearest neighbours while lying, than calves that have met at about 3 months of age (Sato et al., 1987). In addition, 6–8-week-old calves spend more time near familiar calves than unfamiliar ones in a choice test, and familiar calves more frequently lie down close to each other (Færevik et al., 2006, 2007). Like heifers (Hagen and Broom, 2003), young calves are thus able to recognise their peers and seem to prefer them over unfamiliar calves. Also cows in large communal pastures chose their farm companions as their nearest neighbours (Takeda et al., 2000). Dairy calves, regrouped at the age of 2 months, more often displace unfamiliar calves from the feed barrier than familiar ones (Færevik et al., 2007) and preferred heifers tolerate feeding competition better than peers that are mixed later (Bouissou and Hövels, 1976).

Preferred heifer peers tend to rest and eat together (Bouissou and Hövels, 1976) thus, synchronizing their behaviour. Dams and their yearling calves are closer to each other and synchronize their activities more than unrelated animals in a same group (Veissier et al., 1990). Weaning heifers from their dams increases activity synchronization, closeness and licking behaviour between heifers (Veissier and Le Neindre, 1989). In a recent study by Gibbons et al. (2010) synchrony level of dairy cows was found a reliable indicator of sociability, the motivation of individuals to remain close to con-

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specifics (Sibbald et al., 2006). Thus, behavioural synchronization seems to be related to social bonds and preferences between cattle.

Familiarity between cattle seems to enhance their welfare by reducing emotional stress (Takeda et al., 2003), the frequency of aggressions between animals and improving tolerance during activities such as feeding (Bouissou and Hövels, 1976; Færevik et al., 2007). Aggressions among animals can induce stress and injuries and tolerance among peers is likely to help animals to express their behaviours of their own will (Bouissou et al., 2001).

According to Reinhardt and Reinhardt (1982), stable preferential relationships between calves develop before the calves are 0.5 year of age. Bouissou and Hövels (1976) and Bouissou and Andrieu (1978) found that the relationships between cattle are quite permanent; early peers seem to prefer each other for at least 1 year.

In this study, we aimed to answer the question with whom the calves prefer to be near with and, in case a preference to certain partners exists, whether it depends on the amount of time that the animals have been together. We mixed calves with other calves at different ages: at 0.5 month, at 3.5 months and after 5.25 months. We identified preferences between calves in a choice test, then we analysed how long the preference lasts, as seen by behavioural synchrony, nearest neighbour and distance and proximity between animals.

2. Materials and methods

The study protocol was approved by the Ethics Committee for the use of experimental animals at MTT Agrifood Research Finland, Jokioinen. All researchers were licensed to carry out research on animals. The study was performed at the Minkio experimental barn of MTT Jokioinen, Finland. A total of 177 Finnish Ayrshire female calves were used. Only 24 of these, called Type-1 partners, were closely observed, the others serving as their partners. The 24 focal animals will be described in detail. In 2003–2005, twice a year, once in August–September and once in December–January, one group of four calves was formed, yielding a total of six groups. These groups were made when the calves were 0.5 month of age (15 ± 4 days). These calves (i.e. Type-1 partners) stayed together until the end of the experiment, when they were 18 months of age. At 3.5 months of age, the four Type-1 partners were grouped with other calves ($n = 10 \pm 1$), referred to as Type-2 partners. Type-3 partners ($n = 14 \pm 2$) were calves added to the group after the animals were 5.25 months of age. Type-2 and Type-3 animals were all female Finnish Ayrshire calves of the same age as Type-1 partners. They were fed and taken care similarly as Type-1 calves, with the exception that they were housed in groups of 10 ± 1 calves from 0.5 month of age until 3.5 months of age.

Type-1 calves were born in calving pens and separated from their dams immediately after birth. They were then accommodated in individual pens ($0.95 \text{ m} \times 1.2 \text{ m}$) for 2 weeks with teat bucket feeding four times a day. They received colostrum on the first 3 days, after which whole milk and milk replacer were given. Hay, concentrates and water were available at all times. From 0.5 to 3.5 months of age, the four Type-1 partner calves were housed in pens of $3.5 \text{ m} \times 2.9 \text{ m}$, with solid flooring and peat bedding. They were fed formic acid acidified milk and milk replacer *ad libitum* from two teats in the pen until the youngest calf in the group was 8 weeks of age. The calves also received roughage (silage and hay), concentrates and water *ad libitum*. At 3.5 months of age, they were transferred to $4.9 \text{ m} \times 12.6 \text{ m}$ slatted floor pens with cubicles and provided roughage (silage and hay) and concentrates from an automatic concentrate feeder. Water and minerals were available *ad libitum*. All calves were let out to pasture from late May to late September, after which they were housed again in their home barn in $4.9 \text{ m} \times 33 \text{ m}$ slatted floor pens with cubicles until the end of the experiment. They were fed silage and concentrates provided

from automatic concentrate feeder and had water and minerals *ad libitum*. When they were accommodated indoors, the animals had access to the outdoor yard every second day.

2.1. Social preference

The calves' social preferences for partner types were assessed in a Y-maze by performing two-choice tests. The test was carried out in spring 2004–2006, when Age-1 animals (groups formed in August–September) were 9 months old and Age-2 animals (groups formed in December–January) 6 months old. The animals were transported from their home barn to the test barn 1 week prior to the tests. Six animals per group were transported to the test barn at a time: four Type-1 partners, one randomly selected partner from Type-2 animals and one randomly selected partner from Type-3 animals. The husbandry protocol was the same at the test barn as it was at the calves' home barn.

All six animals were habituated to being attached by a rope at the end of the Y-maze arms for 20 min on 2 days, once at the end of the right arm and once at the end of the left arm. The Y-maze consisted of a 2.0-m-long alley, and two arms, each 3.0 m in length. The alley and the arms were 1.2 m wide and delimited by plywood partitions 2.4 m high. The calf to be tested was led to the Y-maze and calves from different partner types were attached by a rope at the end of the arms, one calf to the left arm and the other to the right arm. The attached calves faced towards the middle alley of the Y-maze. The partner choices were (1) Type-1 and Type-2, (2) Type-1 and Type-3 and (3) Type-2 and Type-3.

Each focal calf went through three tests (one test per day and one choice per test). The order of the tests and the sides on which the calves were attached were balanced over the partner types. The Y-maze was divided into five zones delimited by white lines on the floor: a middle zone and two zones near the calves in both arms. The calf to be tested was left in the Y-maze for 5 min. The test was video-recorded and further analysed by using ObserverND software (Noldus, The Netherlands). Latency to enter the zone next to an attached calf (i.e. latency to approach), the first partner the calf contacted, time spent in a zone with an attached calf (i.e. time spent near) and the frequency of contacts were further analysed.

2.2. Spontaneous behaviour

Spontaneous behaviour of the calves was observed for two consecutive days, 6 h a day (from 9 am to 3 pm), over three periods. Period-1 was in the first summer at pasture, when calves were aged 12 months (Age-1) and 9 months (Age-2). Period-2 was in the second winter in the barn, when calves were aged 16 months (Age-1) and 13 months (Age-2). Period-3 was in the second spring in the barn, when animals were aged 21 months (Age-1) and 18 months (Age-2).

Calves were marked with animal spray colours for individual recognition at the beginning of every 2-day observation period. Data were collected by scan sampling every 10 min. The position and behaviour of every calf in a group were drawn on A4 paper. Important resources for the animals, such as lying places, water and feeding places, had been indicated on the paper prior to observations. On each observation day, 37 drawings were made. On each drawing, each animal was represented by an oval symbol, and its identification number was marked on the cranial end and its activity (eating, drinking, standing without doing anything else, moving, being in social interaction, lying head up, lying head down and doing something else) on the caudal end. The basic activity of an animal was finally categorised as lying down or doing something else.

The drawings were analysed with a digitiser board. The x- and y-coordinates of an animal position were taken from the head side

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