Applied Animal Behaviour Science 169 (2015) 1–8

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

# Long-term familiarity creates preferred social partners in dairy cows

Anke Kristina Gutmann[a,*], Marek Špinka[b], Christoph Winckler[a]

[a] Division of Livestock Sciences, Department of Sustainable Agricultural Systems, University of Natural Resources and Life Sciences, Gregor-Mendel-Strasse 33, 1180 Vienna, Austria
[b] Department of Ethology, Institute of Animal Science, Přátelství 815, 104 00 Prague, Czech Republic

ARTICLE INFO

*Article history:*
Received 21 December 2014
Received in revised form 20 May 2015
Accepted 24 May 2015
Available online 30 May 2015

*Keywords:*
Dairy cattle
Preferential relationship
Social behaviour
Nearest neighbour

ABSTRACT

Group is an essential resource for gregarious animals. Dairy cows are however frequently (re-)grouped according to productivity and reproductive state leading to an unstable social environment for the animals. The present study aimed at investigating whether cows maintain social relationships in a dynamic group. Therefore we analysed whether more familiar cows spend more time in close proximity, and interact more often in an affiliative way. Social interactions and direct neighbours during feeding and resting of 12 Holstein cows (1st to 3rd lactation) in a dynamic dairy cow group of 50 animals were assessed continuously over four days using focal animal sampling. A principal component analysis over the twelve assessed social behaviour variables per pair revealed four main components: social relationships may be characterised by time spent as direct neighbours when feeding and interacting affiliative as well as agonistically (excluding displacements), by displacement success, allogrooming interactions, and time spent as direct neighbours when resting. Long-term (shared youth experience, shared adult experience) and short-term (shared dry-period, synchronised group entry) familiarity was associated with higher scores for interacting and being direct neighbours when feeding ($p < 0.05$ for shared youth experience, shared adult experience, and shared dry-period), allogrooming ($p < 0.1$ for shared adult experience × shared dry-period), and being direct neighbours when resting ($p < 0.05$ for shared youth experience × shared adult experience). Long-term familiarity had a stronger effect on the intensity of social relationships, i.e. regarding investment of time and energy, than very recent shared experience. These results support the notion that dairy cows actively maintain valuable dyadic relationships. In practical terms, keeping well-acquainted cows together may contribute to a stable inner structure of a dairy herd and thus promote dairy cow welfare.



## 1. Introduction

Group is an essential resource for gregarious animals, and as such potentially related to biological fitness, health and welfare (Mendl and Held, 2001; Špinka, 2012). Isolation, the risk of social exclusion, or threat to social bonds elicit physiological and behavioural stress responses (Aureli and Smucny, 2000). Proximity, security, or assurance of social bonds on the other hand elicit responses that facilitate and reinforce to maintain the situation. In the long-term, such a physiological and emotional state has 'stress-buffering' effects, i.e. it promotes coping with and recovery from non-social as well as social stress (Cohen and Wills, 1985; Kikusui et al., 2006). A secure and positive social environment therefore has beneficial short-term as well as long-term effects both on psychological and physiological health and resilience (Hennessy et al., 2009; Karelina and DeVries, 2011). There is growing interest in considering this so-called 'social buffering' in farm animal health and welfare (Rault, 2012). The importance and complexity of individual dyadic relationships within a group and their potential social buffering effectiveness differ between and also within species depending on various factors including ecological aspects, social structure, strength of bonding or relationship quality (Hennessy et al., 2009; Pollard and Blumstein, 2012). Either way, social interactions form the basis: social structure can be divided into patterns of individual social relationships differing in nature and quality, that are in turn defined by content, quality and patterning of social interactions (Hinde, 1976). Depending on the physical appearance of the involved animals, e.g. muscle tension and strain, and depending on the outcome of an interaction, i.e. roughly said whether the distance between the animals is reduced, maintained, or increased, interactions are distinguished into affiliative, neutral and agonistic ones to describe animal social relationships.

* Corresponding author. Tel.: +43 1 476543257; fax: +43 1 476543254.
*E-mail address:* anke.gutmann@boku.ac.at (A.K. Gutmann).

http://dx.doi.org/10.1016/j.applanim.2015.05.007
0168-1591/

Based on observations of extensively kept or semi-wild domestic cattle groups (Schloeth, 1961; Hall, 1983; Reinhardt et al., 1986), cattle ancestors lived in stable groups of largely related females and their young offspring, and probably experienced fission–fusion dynamics, i.e. temporarily joining with and splitting from other groups for foraging, resting, or migrating (Cornélis et al., 2014; van Vuure, 2014). Such a social environment is supposed to promote individualised long-lasting, complex, and valuable relationships (Hamilton, 1964; de Waal and Tyack, 2003; Aureli et al., 2008). Cases of 'friendship' have been reported among adult cattle (Sambraus, 1976) and are frequently mentioned in standard textbooks on cattle social behaviour (Bouissou et al., 2001) even though systematic and hypothesis-driven studies on relationship quality in cattle are lacking.

For dairy cows, loose group housing is nowadays widely implemented, facilitating choice of social partners and expression of social behaviour. However, the social environment in large-scale dairy herds of hundreds of animals is fragile and demanding: It is well documented that husbandry routines, namely regrouping, large group-size, and high stocking density, lead to an increase of agonistic interactions combined with a decrease in feeding and lying time (Raussi et al., 2005; DeVries and von Keyserlingk, 2006; Huzzey et al., 2006; Gupta et al., 2008; von Keyserlingk et al., 2008; Hill et al., 2009), have effects on fertility (Dobson et al., 2001), weight gain and health in calves (Pedersen et al., 2009), and productivity (Arave and Albright, 1976; Brakel and Leis, 1976; von Keyserlingk et al., 2008). On the other hand, results of regrouping experiments comparing single versus pair- or group-wise integration into a herd provide evidence that the presence of familiar peers positively influences behaviour and helps to alleviate stress (Bøe and Færevik, 2003; for calves: Færevik et al., 2007; O'Connell et al., 2008; Gygax et al., 2009). In large intensive systems, social adaptability could conceivably be overstrained and dairy cows may no longer be able to maintain individualised relationships. The possible consequences of living in an unstable and rather anonymous social environment on emotional and physiological wellbeing, health and resistance, and on the ability to benefit from the group through social buffering of stressful events, or positive emotional experiences, have rarely been considered yet (Jóhannesson and Sørensen, 2000; DeVries et al., 2003a; Rault, 2012).

The present study therefore aimed at investigating whether indicators of preferential social relationships differ between pairs of dairy cows depending on their familiarity. Our hypothesis was that cows seek to maintain stable relationships and therefore spend more time and interact more often in an affiliative way with their most familiar herd mates. Social relationships among cows were assessed on the basis of time they spent in close proximity and frequencies of social interactions, which are common means in the study of non-human animals' social relations (Whitehead, 2008).

## 2. Animals, material and methods

The study was designed according to European and Czech laws and current guidelines for ethical use of animals in research. The study was approved by the Institutional Animal Care and Use Committee of the Institute of Animal Science (Permit Number 09/2010).

### 2.1. Study site, animals and management

The data presented here were collected from videos that had been recorded in April and May 2011 at the research farm 'Netluky' of the Institute of Animal Science, Prague, Czech Republic. The study was carried out in the group of early lactating and high yielding cows comprising ±50 dehorned animals of 70% Holstein breed (9900 kg average 305 day milk yield) and 30% Czech Spotted breed (7800 kg yield). Introduction into this group after calving occurred about twice per week (2–5 animals together). Prior to calving, dry cows and pregnant heifers (last three months before calving) were kept together in a separate barn. A few days before calving cows were individually moved into an adjacent part of this barn which allowed full visual and olfactorial, and partly physical contact to the group of dry cows and pregnant heifers. Calving took place in an adjacent single calving pen, and the first three to ten days after calving the cows were kept separated from the other groups in single stalls in a separate building. The early lactating group was housed in a 30 m × 15 m stable with curtain ventilation system that contained a 30 m feeding face with neckrail, 54 cubicles with straw bedding (1.35 m × 2.4 m) in two rows facing each other and one row facing the wall, concrete corridors littered with small amounts of straw, two water troughs, two salt licks and an automatic brush. The animals were fed ad libitum (fresh feed twice daily at about 06:00 and 14:00 h) with a total mixed ration (TMR). Milking was carried out by alternating two pairs of milkers twice daily at 03:30 and 15:30 h in a 2 × 5 automatic tandem milking parlour. The corridors were cleaned twice daily during milking with a skid loader.

### 2.2. Focal animals and behavioural observations

For the video recordings, nine IP-cameras (Sanyo VCC-HD 2300P with YV2.8x2.8SASA2 lenses) were installed at about 3–4 m height all around the barn. Videos were recorded on a digital hybrid video recorder (NUUO® NDVR-16-1TB) in colour without sound at a resolution of 1024 × 768 pixels and 12.5 frames per second.

For individual recognition, all animals in the group were marked with large symbols (about 50 cm in diameter) on both flanks using hair-dye ('Kurcreme Oxid' (9% hydrogen peroxide) and 'Bleaching Powder dust-free' by ROMA Friseurbedarf, Robert Maurer GmbH, Laxenburger Straße 165-171, 2331 Vösendorf, Austria).

Data were collected during three periods of four consecutive observation days. Per period, four Holstein cows each were observed using continuous focal observation for 5.5 h per day, alternating from 13:00 to 19:30 h (including a break of ±1 h during afternoon milking), and from 07:30 to 13:00 h. Focal cows were chosen in order to cover a broad range of individual experiences with farm life, with the group, and single group mates. The focal animal group thus consisted of 12 cows, six of them freshly introduced after calving (start of observation) in 1st, 2nd and 3rd lactation, respectively, and six age-matched resident cows (4th to 5th week of lactation) observed in parallel. During the four-day observation periods no further cows joined or left the group except one occasion were a cow had to be removed due to health problems.

Data were collected by one person continuously from the videos using Mangold INTERACT® (programme version 9.6.4.375) video analysis software and comprised start and end time of basic activity of the focal animals (feeding, standing and lying in a cubicle, and standing at or walking through the corridor), start and end time and identity of direct neighbours during feeding and cubicle periods, and start and end time, type of, and identity of the partner in social interactions (for definitions see Table 1). As a basis to calculate frequencies of independent repeated encounters between cows, meal and non-meal bouts were extracted from the raw data. Following DeVries et al. (2003b), meal criterion was set to 30 min, i.e. a meal bout started with the first feeding activity after 30 min without feeding or after leaving a cubicle, a non-meal bout accordingly when entering a cubicle or after 30 min without feeding. Frequency of repeated encounters was defined as being neighbour and/or interacting during independent meal and non-meal bouts.