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Social licking in dairy cattle—Effects on heart rate in performers and receivers

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ABSTRACT

Using heart rate (HR) measurements we investigated whether potential calming effects of social licking were evident for both active (performers) and passive (receivers) licking partners. A HR decline was assumed to indicate relaxation and thus the experience of positive emotions. Effects of the licking category (spontaneous, solicited), the animals' basic activity (standing, lying) and the licked body region (head, neck, rest) were also considered.

Two studies (A, B) were carried out in the same loose housed Austrian Simmental dairy herd. HR was recorded in up to 20 focal animals on 16 and 18 days, respectively. Using either direct observations (A) or video recordings (B), social licking interactions were continuously observed. The cow's basic activity was recorded using scan sampling at 5 min intervals. Linear mixed effects models were applied separately for Study A and B in order to compare the mean HR of the licking bouts with the mean of the respective 5 min pre- and post-licking periods.

In receivers we found a significant calming effect in terms of a HR decline during allogrooming in both studies (A: −1.3 beats per minute, B: −1.1 bpm). This effect was more pronounced when animals were standing (A/B: −2.4 bpm/−3.8 bpm). However, it was not affected by the licked body region.

In dairy cows performing social licking, we did not find an overall calming effect. On the contrary, in Study B, HR significantly increased during licking in lying performers (+2.5 bpm). This reaction was even stronger, when licking was directed to the receivers' head (+3.5 bpm) or neck (+3.0 bpm) as compared to the rest of the body (+1.4 bpm). The licking category had no effect on HR changes during the licking events.

Our findings suggest that relaxation effects induced by social licking differ between performers and receivers and are affected by the cows' basic activity. In receivers, there were clear indications of a calming effect implying the experience of positive affective states. In performers, such calming effects during social licking were not identified.

1. Introduction

Social licking in cattle forms part of maternal care (dams licking their offspring) and reproductive behaviour (bulls licking cows in oestrus) but is also common between growing and adult cattle (Kiley-Worthington and de la

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Plain, 1983; Schloeth, 1961). The latter has been described as socio-positive tactile contact performed either spontaneously, after solicitation or after agonistic interactions (Reinhardt et al., 1986; Reinhardt, 1980; Sambraus, 1969). Social licking in cattle has been proposed as enjoyable and beneficial behaviour and several functions have been hypothesised. Apart from the obvious hygienic effect of itches removal and coat cleaning (Kiley-Worthington and de la Plain, 1983; Sato et al., 1991) it may contribute to establishing and maintaining inter-individual bonds and cohesion within the group (Kiley-Worthington and de la Plain, 1983; Schloeth, 1961). According to Reinhardt (1980), there is an obvious positive effect of allogrooming in the long term as the animals benefit from a stable and relaxed social environment. However, there is also evidence that allogrooming is rewarding in the short term and may evoke positive emotions. Appeasing (Reinhardt et al., 1986) and tension reducing (Sato et al., 1991) effects have been mentioned especially when occurring in the context of conflict or stress (Sambraus, 1969). The experience of pleasure while receiving allogrooming may be deduced from behavioural indications such as stretching the groomed part of the body, slightly raising the tail or half closing the eyes (Reinhardt et al., 1986; Reinhardt, 1980; Sato et al., 1991).

First scientific evidence for physiological calming effects in terms of heart rate (HR) deceleration in animals receiving grooming was found in cattle (Sato and Tarumizu, 1993) and primates (Aureli et al., 1999; Boccia et al., 1989). In horses the simulation of grooming has also shown that positive tactile contact affects the activity of the autonomic nervous system (Feh and de Maziéres, 1993; McBride et al., 2004). However, in all studies dealing with physiological reactions to allogrooming the sample sizes were rather small and data analyses partly questionable. The studies only focussed on the passive grooming partners while reactions of the active animals have not been investigated so far. Short-term rewarding effects on the performer appear to be less clear cut and Boissy et al. (2007) even speculate that for low ranking cows the performance of allogrooming might even be stressful, especially when initiated by dominant cows.

HR changes have been recommended as suitable parameter in order to demonstrate emotional changes in animals (Desire et al., 2002) and have already been applied in this context in heifers (Takeda et al., 2003), sheep (Reefmann et al., 2009) and greylag geese (Wascher et al., 2009). Attempts have also been made to demonstrate varying physiological reactions when grooming is received at preferred versus less preferred body regions (Boccia et al., 1989; Feh and de Maziéres, 1993; Schmied et al., 2005; Schmied et al., 2008).

The aim of our study was to investigate the physiological effects of social licking in terms of HR changes in performing and receiving dairy cows. A decrease in HR during licking was assumed to indicate relaxation resulting from the experience of positive emotions (Boissy et al., 2007). Furthermore, we hypothesized that self-initiated licking events, i.e. spontaneous licking in performers and solicited licking in receivers, would result in stronger HR effects. We also investigated, whether HR changes differ according to the animal's basic activity and the body region licking is directed at.

2. Animals, material and methods

2.1. Experimental conditions

The investigation was carried out in two parts, referred to as Study A and Study B below. Study A was conducted on 16 days in October and November 2005 while Study B took place on 18 days from February to April 2007. Both studies were conducted in the herd of Austrian Simmental cows at the Agricultural Technical School of Pyhra in Lower Austria. During the study periods the herd comprised up to 30 cows and the average milk yield per cow and year was 10.076 kg and 10.169 kg in 2005 and 2007, respectively.

2.2. Animals and housing conditions

From the study herd up to 20 lactating cows were selected as focal animals. Mean age of focal animals was 4.0 (range 2–8) and 5.4 years (range 2–13) and mean lactation number was 2.2 (range 1–6) and 3.4 (range 1–10) in Study A and B, respectively. The average daily milk yield was 30 (SD 9) and 36 kg (SD 11). Cows were kept in a loose housing system with three sloped deep-littered lying areas of 29 m^2, 35 m^2 and 44 m^2 and two concrete floored feeding alleys. Fresh bedding (straw) was provided twice daily and the cows had free access to a concrete outdoor loafing area. The cows were milked twice a day at 4:30 am and 4:30 pm. After milking they were fed fresh corn silage while being locked in the feed rack for about 1 h. In the outdoor run the cows had ad libitum access to grass silage via a self-feeding fence. According to milk yield the cows were provided concentrates through two concentrate dispensers inside the barn. Water was offered in three troughs, out of which two were located inside and one in the outdoor loafing area. Two automatic rotating and one fixed cow brush were available in the barn.

2.3. Monitoring cardiac activity

Twenty sets of POLAR® heart rate monitoring devices were used. Each set consisted of a 'POLAR® Equine T52 H™ Coded Transmitter' with electrodes and a 'POLAR® S810i™ Heart Rate Monitor' in the form of a watch receiver. After the morning milking, while the cows were locked in the feeding rack, the electrodes and transmitters were attached to the rumen side of the focal animals on an elastic girth belt. The positive electrode was placed behind the shoulder blade near the withers. The negative electrode was fixed on a ventral position close to the heart. At the electrode's position the coat of the cows was moistened and ultrasound gel was applied in order to enhance transmission. The transmitter was placed half way between the electrodes. As suggested by Hagen et al. (2005) and Schmied et al. (2008), we adjusted a second elastic girth in order to keep the electrodes and transmitter in place and to carry the watch receiver. For heart rate (HR) measurements, inter-beat-intervals were continuously stored for about 3 to 4 h. In Study A, one recording period was carried out per day and transmitters were removed afterwards. In Study B, how-