Applied Animal Behaviour Science 128 (2010) 30–36

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

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

Social hierarchy affects the adaption of pregnant sows to a call feeding learning paradigm

Gerhard Manteuffel[a,*], Anja Mannewitz[a], Christian Manteuffel[a], Armin Tuchscherer[b], Lars Schrader[c]

[a] Leibniz Institute for Farm Animal Biology (FBN), Unit Behavioural Physiology, Wilhelm-Stahl-Allee 2, 18196 Dummerstorf, Germany
[b] Leibniz Institute for Farm Animal Biology (FBN), Unit Genetics and Biometry, Wilhelm-Stahl-Allee 2, 18196 Dummerstorf, Germany
[c] Friedrich-Loeffler-Institute (FLI), Institute of Animal Welfare and Animal Husbandry, Doernbergstr. 25/27, 29223 Celle, Germany

ARTICLE INFO

Article history:
Accepted 13 October 2010
Available online 11 November 2010

Keywords:
Domestic pig
Rank order
Acoustic calling
Learning
Memory
Cognitive enrichment
Welfare

ABSTRACT

The aim of the study was to test whether adult sows are able to learn an individual acoustic signal for call-feeding in groups supplied with an electronic feeder. Further, we investigated whether and how the social rank of sows affects learning success. Thirty-six sows were examined in 6 successive trials. In each, the animals were kept together for establishing a social hierarchy a week before conditioning started. Agonistic interactions were observed and a dominance index (DI) was calculated for the sows of each trial. Based on the DI sows were categorised as (1) dominant, (2) subordinate, or (3) submissive. Afterwards groups were transferred to the experimental pen which was equipped with one electronic feeder supplemented with a loudspeaker and software, the call-feeding station (CFS). The training started with classical conditioning (7 days) where the animals entered the CFS spontaneously 6 times daily and received a portion of feed immediately after an individual acoustic signal had been played. In the following operant conditioning phase (13 days) the individuals had to learn that they could enter the CFS and receive feed only after they had heard their signal. The animals were called 6 times daily to feed the respective fraction of the daily feed allowance. On the average, after 8 days of operant conditioning the animals reached the learning criterion of following 80% of their calls. The success rates differed significantly between the three rank groups. In the dominant and subordinate groups 93% and 71% of the animals reached the learning criterion at the end of the experiment after 13 days of operant conditioning, while only 64% of the submissive sows did so. If only the number of successful, i.e. rewarded, enters of the station was considered those submissive animals who had reached the learning criterion did not differ significantly from the others. During learning, the time required to approach the CFS decreased significantly as well as the rate of false attempts to enter if another animal was called. At start of the operant training dominant sows blocked the entrance of the CFS. With increasing learning success of these sows this behaviour decreased significantly. The experiment has demonstrated that call feeding can be applied successfully with pregnant sows. It has the potential to increase animal welfare because, by calling them individually to the feeder, it provides the animals with a positive short time anticipation of unaffected feeding.

* Corresponding author. Tel.: +49 38208 68800.
E-mail address: manteuff@fbn-dummerstorf.de (G. Manteuffel).

0168-1591/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.applanim.2010.10.002

1. Introduction

In modern group housing of pregnant sows electronic feeding is a common practice. Besides advantages, such as the controlled and protected feeding of individual animals, there are also some drawbacks. Sows may compete for the access to the feeder which may lead to severe injuries (Boyle et al., 2002). In addition, animals who have already received their daily feed allowance may be frustrated when they try to enter the feeder again. Frequently there is a high animal-to-feeding place-ratio so that the animals can hardly know when they will have access. This further may intensify aggressive competition for the entrance (Bünger and Kallweit, 1994; Anil et al., 2005). Low ranking young sows may be particularly affected by this situation. An impaired access to the feeding place will also maintain the motivation for oral activity which may lead to misdirected appetitive behaviour exercised on pen equipment or group mates.

In order to overcome these difficulties with electronic feeding we have developed a call feeding system that was derived from a previous research project with growing pigs (Ernst et al., 2005; Manteuffel, 2009). There it had been shown that the animals are well able to discriminate an individual acoustic call to a feeding place from those of other individuals. As a result the animals entered a 'call-feeding-station' only if their individual calling sound was heard being emitted by a particular station where they could receive feed. In this setup four feeding stations were provided for a group of eight animals and feeding occurred up to 31 times a day per animal. Less fearful animals with less maladaptive behaviour and some beneficial health features resulted from this feeding regime (Ernst et al., 2006; Puppe et al., 2007).

By calling individual animals to an electronic feeder it is expected that, after learning, the animals cease to be mutually aggressive in front of the feeding station. Then, they know that only if they hear their individual call they surely get feed, but never if the particular sound has not been played before. Hence, mutual aggressiveness while fighting for positions close to the feeder would not lead to any advantage for them.

Call feeding has also the potential to be a 'cognitive enrichment' (Manteuffel et al., 2009a). Learning an instrumental behaviour, as following an acoustic summons in order to get a reward, includes three consecutive phases: first, the detection of a discriminatory stimulus that is contingent to the primary motivating feed reward, second, shaping of behaviour to get access to the reward, and finally complete control over the task. In the last two phases, anticipating reward after the appropriate instrumental behaviour has a positive emotional effect (Martin and Ono, 2000; Spruijt et al., 2001; Manteuffel et al., 2009b). Anticipation and behavioural control – the certainty that the appropriate behaviour will result in the expected outcome – are relevant factors for increasing the welfare of animals (Bassett and Buchanan-Smith, 2007).

In order to test pregnant sows for their ability to adapt to individual call feeding we have modified a commercial electronic feeder to call animals out of a small group to feeding. In common electronic feeders individual animal recognition is already included so that an important requirement was already fulfilled. We have added a software routine for training and calling the animals and recorded the speed and quality of learning. With this setup we tested the hypotheses that (1) group housed sows are able to learn an individual acoustic signal as a call for feeding, irrespective of their social position in the group, and that (2) during the training dominant behaviour decreases, particularly blocking the access to the feeder's entrance.

2. Material and methods

2.1. Animals and housing

The present study was conducted in the experimental pig unit of the Leibniz-Institute for Farm Animal Biology (FBN), Dummerstorf, Germany.

Forty-eight pregnant sows (German Landrace, 9th/10th week of pregnancy) were gathered in six test groups ($n = 8$ sows per group) for sequentially replicated trials. Before being grouped for the experiments all sows had been group housed (group size in each home pen = 4 animals, according to the usual conditions in the institute's pig unit) with feeding boxes (Jyden Dantec JB5000) and an animal to feeding place ratio of one. The feed consisted of standard feed-pellets for pregnant sows (Trede & von Peine, Landhandel und Mischfutterwerke, Dammfleth, Germany, feed allowance 2400 g/day). Water was available *ad libitum*. Within the test groups the ages ranged randomly from 10 months (first parity) to 1 year 8 months (fourth parity).

Twelve animals had to be removed because they were not fertilized ($n = 3$) or were injured in fights immediately after mixing for the experimental groups ($n = 4$) or had problems with the new feeding situation already with standard electronic feeders ($n = 5$). Hence, the entire experiment was carried out until the end with 36 animals (trial, number of animals): (1, 7); (2, 5); (3, 6); (4, 5); (5, 6); (6, 7).

2.2. Experimental setup

After one week of social habituation of the experimental groups by joining two adjacent home pens with feeding boxes, the experimental groups were transferred to the experimental pen (Fig. 1) measuring 7.20 m × 5.50 m (partially slatted floor: 7.20 m × 2.00 m) which was partially separated by a wall ($L \times H$: 3.00 m × 1.50 m) to create a hiding area. The pen was equipped with an automatic electronic feeder modified as a call-feeding-station (see below). The experimental schedule and the measured variables are depicted in Fig. 2.

2.3. Determination of the rank groups

Agonistic interactions (AI) were observed as overt fights or displacements of dyads of sows with physical contact initiated by one individual, resulting in any form of submissive behaviour by the opponent (for a detailed description of typical fighting elements see Rushen and Pajor, 1987; Langbein and Puppe, 2004; Puppe et al., 2008). AI were directly observed in each experimental group for two hours