Sub-task 3.1.2.3 Training gilts to use a feeder station

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Introduction

Group housing of dry sows is compulsory in Europe from 2013 onwards. Many pig farmers who still have to convert to group housing fear the resulting demand on their ability to interact with individual animals. An example of such interaction is the training of gilts to use economically attractive but complicated feeding systems such as electronic sow feeding stations (ESF). Electronic Sow Feeding is a more complex husbandry system, which requires training from both animal and human. Pig farmers use a wide variety of training methods, ranging from a total free situation where the animals have the possibility to learn the feeding station without human interaction to systems in which the animal is confronted with thorough human interventions. The first method incorporates the risk that some animals do not consume any feed in several days. The second method is more time consuming and sometimes stressful for the animals. If a calm and relaxed training method proves to be an efficient way to train animals, this could also be used in other on farm situations.

Wechsler and Lea (2007) concluded that there is a lack of studies focusing on the initial phase after the introduction of farm animals into a new housing system and a lack of studies on the way they learn to use new housing equipment. An assessment of training systems on Danish pig farms (Hansen and Vinther, 2004) has resulted in the advice not to interact too soon and let the animals discover the skills themselves.

The way the animals experience the human intervention can be assessed by measuring heart rate variability (HRV) (Von Borell et al., 2007). They state that “HRV is a promising approach for evaluating stress and emotional states in animals”.

The results of this project can be used in the knowledge transfer about human animal relationships within the Welfare Quality programme.

Objective

The objective experiment was to test the **hypothesis** that calm & quiet handling will improve learning speed and welfare of gilts. Principles used when training gilts to use feeding stations can also be applied to other practical new and learning situations.

Material and Methods

Animals and handling

In an experiment on the Pig Research Centre in Raalte 18 groups of 4 naïve gilts each (3 groups per week/batch) were trained to use an ESF station. The gilts were selected from near slaughter weight female finishing pigs. The average body weight was 103 kg (90-120) at the start of the experiment. They were selected, weighed and given an ear transponder on Monday, and subsequently housed separately in 3 groups of 4 animals during 7 days (the 'preparation week'). The feed ration in that week was 2.5 kg pelleted feed in one meal per day in a long trough. Four times per week the observer entered the pen, walked around and touched the animals so the pigs got used to this person. On 2 occasions, 2 animals from a group of 4 received a Polar girth transmitter during 2 hours to get used to future heart rate monitoring. On the next Monday morning they were not fed and brought to the ESF pen, where they were kept as a group. In the ESF pen each group was kept for 7 days ('test week'). They were fed individually through the ESF system in a self chosen order. Each group was assigned to one of three treatments (see below). In every batch the order in which the treatment groups were fed was changed randomly.

Housing

In the preparation week the animals were kept in pens with partly slatted floors with 1.5 m² per animal. The animals were fed simultaneously in a long trough along the feeding alley. A drinking bowl was situated above the slatted floor in the back of the pen.

Figure 1 shows the layout of the ESF pen with the Electronic Sow Feeder in the middle and a "pre feeding pen" at the entrance side of the feeder and a "post feeding pen" on the exit side of the feeder. The pigs could not go back to the "pre feeding pen" after they passed the feeder. Two hours after the feeding start of the first group the groups changed pens and the procedure was repeated for the second group. Another two hours later this was repeated again for the third group. The feeder was a Porcode Electronic Sow Feeder (Nedap Agri, Groenlo, NL). The feeding cycle started at 7.00 am, so feed was available from the moment of entrance of the "pre feeding pen". The feed dispensing rate was 120 g/min with a small quantity of water (40 cc water per 100 g feed). The daily ration was 2.4 kg pelleted feed per animal. At night a dim light above the feeder was on.

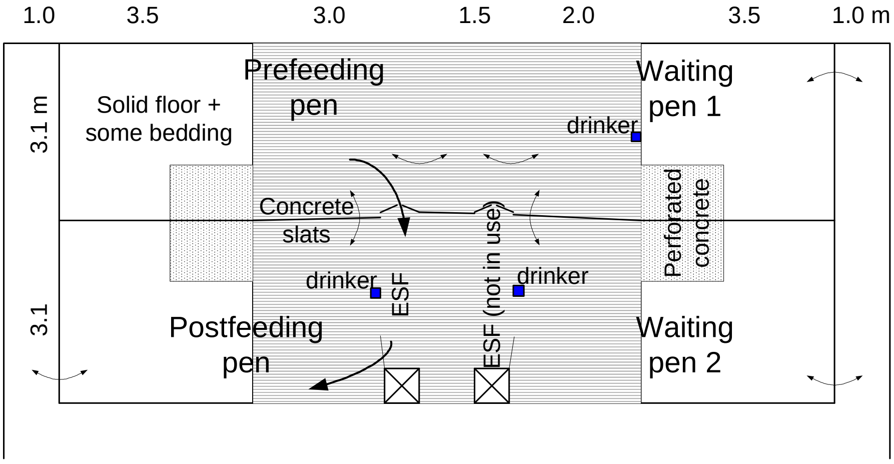

Fig.1. Layout of the experimental pen; a group of 4 gilts started in the prefeeding pen and passed the ESF one by one to the postfeeding pen; meanwhile the other two groups were waiting in the pens on the right side of the room.

Treatments

We used the following three different training techniques, one technique per group. Treatments were applied on Monday, Tuesday and Wednesday:

Minimal: minimal interaction (no farmer interference, just supervision) only after two days without feed intake the sow was triggered with a little bit of feed on the floor;

Gentle: gentle vocal and soft-physical coaching; using the voice and a hand on the back if necessary, a board to point the right direction and always some feed on the floor in the feeder; if an animal refused to enter another one was tried first.

Active: active physical encouragement; the trainer used a loud voice and slapping on the side walls or board, the animals were physically driven to the feeder. If an animal refuses it is still forced to enter the feeder, with the aid of a large board.

The treatments started in a random order per batch at 8.00 h, 11.00 h and 14.00 h. After a habituation period of 10 min the pigs were free to go to the feeder. In the two “intervention” treatments the animals closest to the feeder when the intervention started were guided or driven to the entrance one by one. See photo on the right. The exit of the feeder was blocked in the first 3 minutes after entrance to prevent an animal passing the feeder without eating. The animals in the third group, starting at 14.00 h stayed in the post feeding pen until the next morning. The feed intake of some of the animals was so low that they were given a second chance to eat. However this was only done after the 30 min post feeding period and was not included in the observations. The same treatments were applied during these prefeeding periods. On Thursday and Friday the animals received no human intervention.

Photo 1. Prepared for HR-observations

Photo 2. Situation in the ESF-pen

Observations

From every sow we recorded the entrance and exit time on day 2 and day 4 (Tuesday and Thursday). On the same days we measured heart rate data from 2 of the 4 animals in every group. HR was recorded with Polar S810 (Polar Electro OY, Kempele, Finland), which consisted of a girth belt with built-in transmitter and a wristwatch receiver. The girth belts were attached shortly before the start of the training session and removed after finishing the training session, about 2 h later. The belts were protected with tape against the teeth of curious pen mates.

The heart rate recordings were split into three periods: 1) prefeeding, just before entering the feeder, duration 10 min. 2) feeding, the time the animal stood in the feeder, 3) postfeeding, started when leaving the feeder, duration 30 min. In between these periods we excluded 2 minutes to prevent the observations from being disturbed by sudden movements when entering and leaving the feeder and by lack of synchronicity of clocks of Polar and VCRecorder (behaviour study). There was at maximum 1 minute difference between the video time and the Polar time. Mean HR and HRV measures were calculated after systematic removal of artefacts on the basis of visual inspection. Approximately 7% of the beats in individual HR recordings were not used because of excessive artefacts. In general, the quality of the series of heart rate measurements was poor for both part of the animals and part of the periods. For instance animals with repeated periods without signal (0) or the maximum (255) heart rate were of too low quality. We selected only the animals with reliable measurements in all three periods (prefeeding, feeding and postfeeding). Of the 72 measurements 38 (53%) could be used in the final analysis. (6 batches x 3 treatments x 2 days x 2 animals = 72 measurements)

From these heart rate observations we calculated the mean heart rate in beats per minute and the heart rate variability (HRV) as root mean square of successive beat-to-beat differences (RMSSD). An example of an heart rate recording is shown in figure 2.

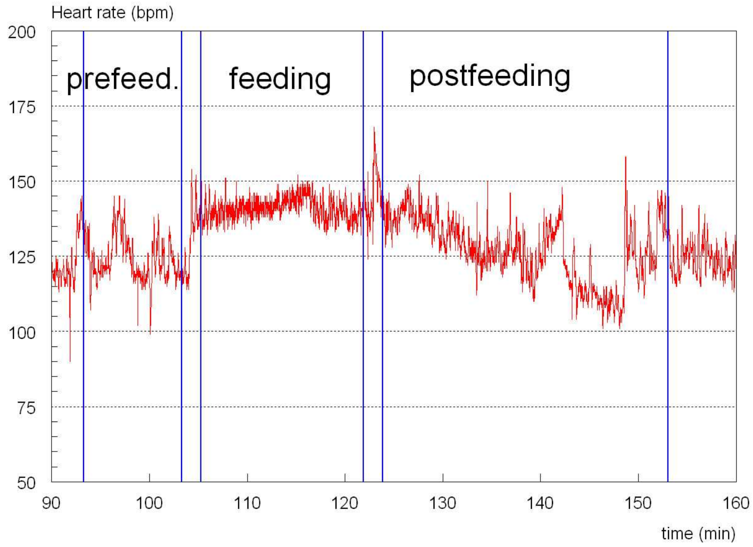

Fig.2 Example of heart rate recording during 2.5 hrs, split up in three periods.

Statistical analysis

The time for a group to pass the feeder was analysed using "General Analysis of Variance" (Genstat, 2007) with the model duration = μ + training method + day of the week + interaction + e. The difference in duration between day 2 and 4 was analysed with only the factor "training method".

The heart rate (BPM) and the heart rate variability (RMSSD) per individual pig were analysed using the REML procedure of Genstat (2007). The variable RMSSD was transformed to 1/RMSSD. The model was BPM/RMSSD = μ + training method + day of the week + interaction + e.

Results

All the gilts passed the feeder at least once per day, also in the Minimal group. It took the 4 animals of a group on average 1 h and 21 min to pass the Electronic Sow feeder. The statistical analysis showed no difference between treatments or day of the week on passing time. Also the difference between day 2 and 4 was not significantly different. Figure 3 shows the average passing time for a group of 4 animals per training method and day of the week. The group without intervention showed a "learning effect" which was 14'40" quicker, the gently treated

animals were 12 minutes slower and the forced animals were 1'30" quicker, but these differences did not show statistically significancy.
On average after 30% of the visits the total ration was not dispensed. This was on average 216 g per visit or 716 g per visit with not completed rations. Secondary visits to the feeder were not included in the final data. From Monday to Friday no differences or tendencies were present.

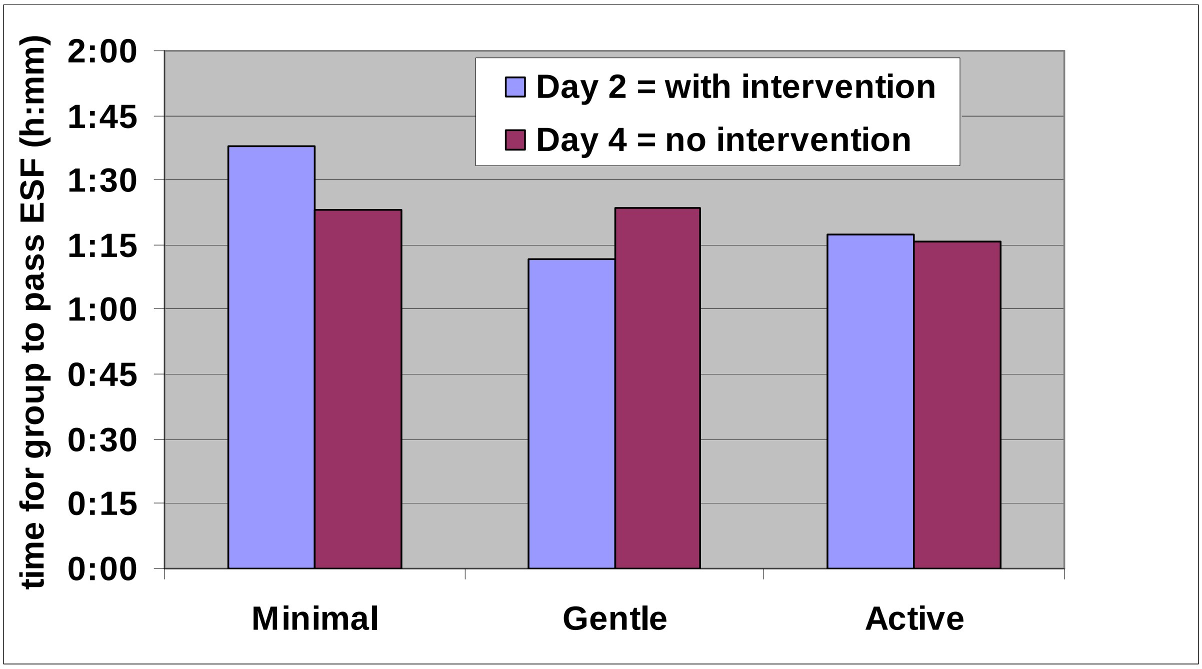

Figure 3. Average passing time for a group of 4 animals per training method and day of the week.

The quality of the heart rate measurements was poor for part of the animals and part of the periods, possibly caused by other animals biting on the tape around the girth collar and activity of other thoracal muscles. We selected only the animals with reliable measurements in all three periods (prefeeding, feeding and postfeeding).

The only significant differences for heart rate and heart rate variability were found between the different periods. Table 1 presents the estimates of the statistical analysis. Figure 4 presents the results graphically, including the treatment. The heart rate was lowest before feeding, highest during feeding and intermediate after feeding ($P<0.001$), but without differences between the training methods.

Table 1. Estimates of heart rate and heart rate variability per period.

	Prefeeding	Feeding	Postfeeding	Significance
BPM	120.9^{a}	136.1^{b}	124.7^{c}	P<0.001
HRV	12.85^{a}	9.34^{b}	17.51^{c}	P<0.001

^{abc}Numbers with different superscripts differ significantly (P<0.05)

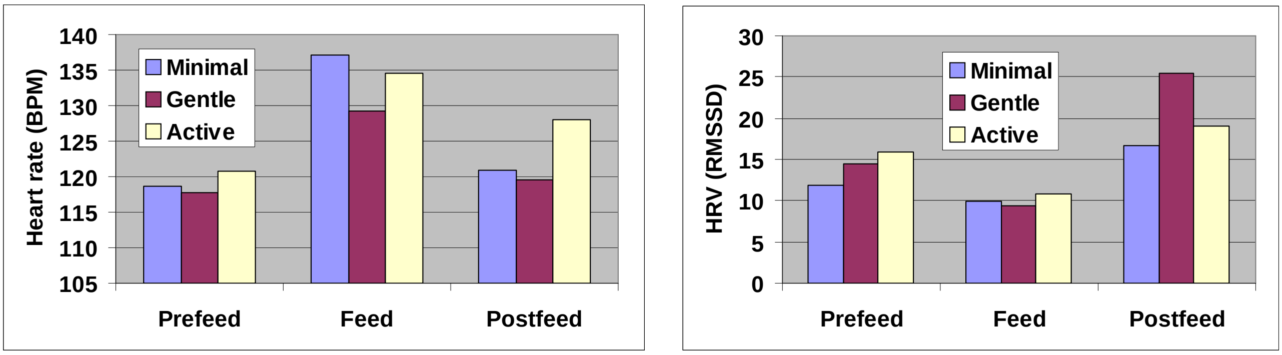

Figure 4. Estimated values for heart rate and heart rate variability per treatment and period.

Discussion

Learning to use the Electronic Sow Feeder was easy in a group of 4 gilts. All the animals used the feeder from the first day with an average visiting time of 20 minutes. Some animals left the station before they finished their total daily ration, and the feed intake did not improve as the testweek went on. Only in the treatment without human intervention the time for the group to pass the feeder was longer on the second day and shorter on the fourth day. On day four it was comparable with the duration of the other treatments. The training methods did not affect the time and duration the animals spend to pass the feeder on the first day without human intervention.

The heart rate was significantly affected by the period around feeding. Prefeeding HR was the lowest, Feeding HR the highest and Postfeeding was intermediate. For mean HR there was no indication of differences between treatments. The average HR was around 120 BPM where in socially isolated gilts it was 104 BPM (Marchant-Forde et al., 2004). Within the periods the treatments did not differ significantly..

Heart Rate Variability (RMSSD) was lowest during feeding and highest post feeding. There were no significant differences in HRV for the different treatment groups. So an active human intervention did not result in an increased or decreased HRV. In other studies a decreased heart rate variability is associated with an increased level of stress and hence can compromise pig welfare. In the present study the average heart rate variability was almost 14 where in the gilts of Marchant-Forde et al. (2004) this was 21. This slightly lower value in the current experiment is probably caused by the arousal caused by moving the animals to the prefeed pen and fixing the girth transmitters.

We found no negative effects of any human interventions, but also no advantages for training time. This fits in the Danish advice (Hansen and Vinther, 2004) to optimize the pen design and equipment and to let the gilts "train themselves" in small groups. This also requires less labour from the stockman and does not make the feeding behaviour dependent on human presence. Surprisingly we did not find differences between minimal and active training. Hemsworth et al. (1993) found differences between aversive handling on one side and positive and minimal handling on the other side on fear responses of pigs. In the current study the authors believe that the impact of the short moment to force or to help the animals gently to the feeder on three consecutive days was not a big enough intervention to have an effect on the behavioural and heart rate responses.
The hypothesis that gentle human intervention would help the animals to learn faster without experiencing stress could not be confirmed. One of the reasons could be that the challenge (the task of learning how to use an ESF) in combination with a relatively small group resulted in too less variation to detect any significant difference. A larger group or the presence of older and unfamiliar sows, resulting in aggressive interactions, would certainly make it more difficult.

Conclusions
- Positive nor negative human intervention during ESF training did adversely affect learning speed of gilts as measured by passage time through the feeder
- Neither gentle nor active prefeeding human intervention affected stress as indicated by heart rate and heart rate variability, compared to no intervention.

Practical implications
The results indicate that at least in small groups of gilts the preferred level of human interference when training gilts to use an ESF is a minimal level, because it requires least labour. The general advise based on practical experience is that gilts should be grouped in a prefeeding pen, separated from the post feeding pen, with no possibility to return. This gives the last and probably lowest ranking animals the chance use the ESF without any intervention of dominant pen mates. From experience in this and other studies we recommend that the minimal duration of this training period is 7 days.

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