EAAP 2004
Bled Meeting

Session MCL1

agroscope
FAT TÄNIKON

Swiss Federal Research Station for
Agricultural Economics and Engineering
Tänikon
CH-8356 Ettenhausen

Aggressive behaviour of dry sows fed by means of an electronic feeding system without feeding stalls

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Abstract

The study investigated the behaviour of breeding sows fed by an electronic feeding system in which the sow is not protected from her penmates during feed intake.
Three feeding stations were installed for a dynamic group of 36 sows maximum (maximum animal/feeding place ratio: 12:1). The sows' behaviour at the feeding stations was observed on six different days at three-week intervals. The following behavioural patterns were recorded: 'aggressive interactions with retreat' and 'aggressive interactions without retreat'. In addition, the feeding computer recorded how much time the sows spent at which feeding station and specified whether food was distributed or not.
Clinical examinations of the sows for injuries occasioned by aggression were performed on all sows before entry in the housing system, one week after entry, halfway through gestation and before leaving the housing system. The results were compared with data collected in the same manner in an earlier study of an electronic sow feeding system (ESF) with a closed feeding station.
On average, each sow visited the feeding stations 55.6 times per day with feed intake and 99.9 times per day without feed intake. Displacements of sows at the stations were accordingly frequent. An average of 16.6 incidences of 'aggressive interactions with retreat' and 3.6 incidences of 'aggressive interactions without retreat' were recorded per sow and day. Not all animals displaced other animals from the feeding stations with equal frequency. High-ranking

sows in particular often visited the feeding station without feed intake, thereby displacing the feeding sow from the station.

The results of the clinical study showed that first- and second-parity sows in particular exhibited many aggression-related injuries (38.5 % and 42.7 %, respectively, of the examined body regions), whereas with older, and hence higher-ranking sows (>sixth parity) there was a lower incidence of injured body regions (8.3 %). In the study with the ESF system with closed feeding station, between 3.5 % and 6.0 % only of the examined body regions were affected, with age having no discernible impact.

The results show that restricted feeding of breeding sows in electronic feeding systems without confinement of the sow during feeding is problematic in terms of animal welfare. Low-ranking sows are particularly frequently displaced from the feeding stations.

1. Introduction

Pigs are by nature gregarious animals that spend a large part of each day foraging in groups (Stolba and Wood-Gush, 1989). From studies of wild boars, it is known that the latter exhibit markedly synchronised group behaviour as regards feeding (Hennig, 1998), whilst maintaining a large distance between animals.

In the housing of pregnant sows, this distance between animals during feeding cannot be provided for. In order to prevent aggressive interactions during feeding, the sows are often separated in crates or feeding stalls. In conventional ESF systems, the feeding sow is also protected by a feeding station from being displaced by penmates. The station's entrance and exit are usually physically separate, so that a sow leaving the station is not exposed to the aggression of the animals subsequently entering. In addition, the distribution of roughage can distract the sows whilst they wait at the feeding station, which also enables synchronised group foraging to a certain extent (Morgan *et al.*, 1998; Weber and Friedli, 1991).

Over the past few years, electronic feeding systems have been developed for dry sows which no longer have a closed feeding station, but instead use protection screens to separate the animals. If a sow is recognised at the station and has a feed credit, the feed position opens and dispensing of the feed begins. As soon as the animal leaves the station, dispensing of the feed stops.

The feeding of breeding sows at such an electronic feeding system was studied in Agroscope FAT Taenikon's experimental pig house. The aim of the trial was to assess feeding systems of this type in terms of animal welfare.

2. Materials and Methods

2.1. Feeding system

For the trial, the FITMIX model 2002 system was used, in which the sows are fed via a nipple feeder. If a sow at the nipple feeder is recognised and has a feed credit, a shut-off slide covering the end of the feeding nipple opens. Now the animal can push back a pendulum, whereupon feed dispensing begins. As soon as the animal leaves the station, this pendulum swings back to the starting position and food dispensing ceases. At the same time, the end of the nipple is sealed off again.

2.2. Experimental pen, feeding

The pen, laid out for a maximum of 36 sows, had a littered lying area comprising six sections arranged in a 'U' shape with a total surface area of 40 m^2 and a central defecation and activity area (65 m^2). Three nipple-feeding stations (12 sows per station) were installed in the activity area. Two stations stood immediately next to one another with antiparallel access; the third station stood at a distance of 1.80 m. The feeding cycle started at 6.15 am. The animals in the waiting area were offered straw in a hayrack to keep them occupied.
The animals were given a complete feed (7.5 % crude fibre, 11.5 MJ digestible energy/kg), and were fed according to a standard feed curve (30 - 35.7 MJ/sow/day) with individual adaptation according to gestational stage.

2.3. Recording of behaviour

Two different recording methods were used. In the first, on a total of ten days with differing group composition, the feed computer electronically recorded which sow stopped at which nipple feeding station and for how long, and whether or not any feed was consumed. In the second, six 24-hour video observations were carried out at approx. three-week intervals in each case, with the following behaviour being recorded:
'Aggression with retreat': Biting, shoving or butting in the neck, shoulder, flank or breast region of the sow at the feeding nipple. The attacked sow retreats from the nipple.
'Aggression without retreat': Biting, shoving or butting in the neck, shoulder, flank or breast region of the sow at the feeding nipple. The attacked sow does not release the nipple.
Recordings only occurred when there were at least 30 sows in the group.
The experimental group was a dynamic group of gilts and older sows.
The sows' rank within the groups was not determined from behaviour; rather, the sows were divided into parities (1st gestation, 2nd gestation, 3rd-6th gestation, more than six gestations). Since age and rank are highly correlated (Drickamer *et al.*, 1999; Hennig, 1998), these parities correspond with high probability to rank.

2.4. Clinical examinations of the sows

During the trial, each sow was examined at intervals for external injuries and changes to the skin. The examinations took place before entry into the housing system, one week after entry (end of the fights for rank), halfway through gestation, and before leaving the housing system.

The following body regions were assessed:

- head
- ears
- neck/shoulder
- breast/flank
- back
- lumbar-sacral region
- upper hind leg
- anogenital region

These body regions were rated according to the following scale:

- severity grade 0 = no change
- severity grade 1 = few, small, scabbed-over scratches
- severity grade 2 = several clearly visible lacerations or bite marks, fresh or scabbed over
- severity grade 3 = deep lesions, fresh or scabbed over; extensive lesions

The results of this clinical examination were compared with an examination (Weber and Friedli, 1991) in which 32 sows at an ESF system with closed feeding station were housed in the same pen and with the same management as in the present examination.

The percentage of body regions with severity grade 2 changes per sow at the end of gestation was selected to illustrate the results of the clinical examinations of the present study.

2.5. Statistical comparison

To calculate the means of the behaviour parameters, the sows' data recorded on a number of occasions in the same gestation was first averaged. Further calculations were carried out with these animal-specific means. For the graphic representations (box plots), however, the individual measured values for each animal were used.

The Kruskal-Wallis test was used for the statistical comparison of the means between the different parities.

3. Results

3.1. Visits to the stations during the course of the day

Shortly after the start of a feeding cycle, at 6.15 am, there was relatively little place-swapping at the stations, since the high-ranking sows were feeding at this time (Fig. 1). After this the frequency of occupancy of the station rose sharply, and for several hours over 150 occupancies per hour were recorded. The frequency of occupancy decreased again later in the afternoon. At nighttime, the sows scarcely visited the stations.

Throughout the entire day, the majority of visits to the station were not connected with feeding. At peak times, between 100 and 140 station occupancies per hour were visits without food intake.

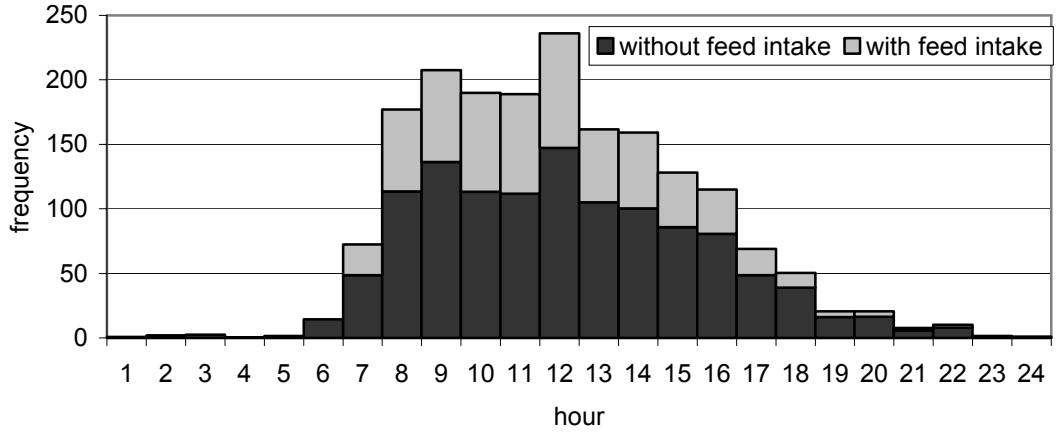

Fig. 1: Average frequency of occupancy per feeding station with and without feed intake during the course of the day (start of the feeding cycle: 6.15 am).

The average duration of occupancy per feeding station showed a similar trend to the frequency of occupancy (Fig. 2). After the start of the feeding cycle at 6.15 am, the station was occupied for between 40 and 50 minutes per hour for several hours. Towards late afternoon, the duration of occupancy decreased. The duration of occupancy of the station without feed intake in the first few hours stayed fairly constant at 20 minutes per hour. Only later in the afternoon, once most of the sows had fed, was the proportion of occupancy time without food intake higher than time with food intake.

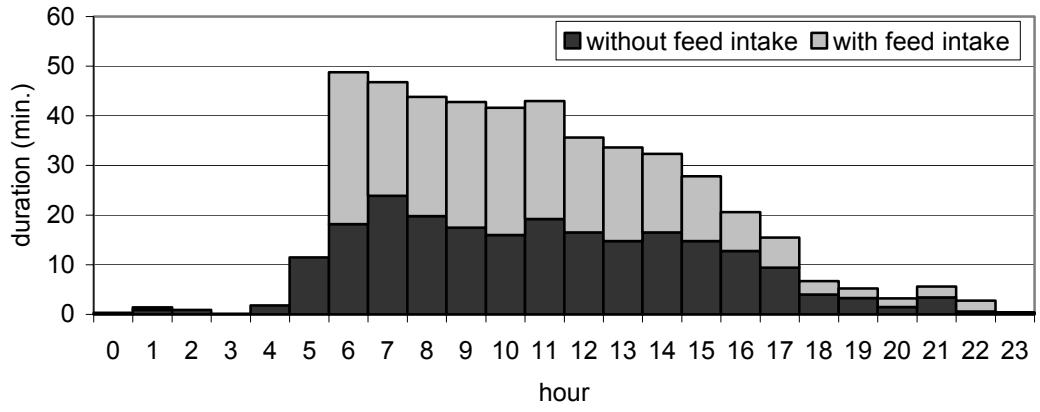

Fig. 2: Average duration of occupancy per feeding station with and without feed intake during the course of the day (start of the feeding cycle: 6.15 am).

3.2. Frequency of visits to the stations

On average, sows visited the feeding station 155.5 times a day, with no significant difference existing between parities. In terms of visits to the station with food intake, however, the behaviour of sows of different parities varied significantly ($p<0.01$; Fig. 3). Thus, gilts only visited the station 27.1 times to feed, whereas the older sows visited 65.8 times (3^{rd}-6^{th} parity) or 55.6 times (> 6^{th} parity). With the exception of the gilts, one-quarter of the sows visited the stations over 80 times in order to consume their feed credit. In extreme cases, over 200 visits with food intake were observed. The lower frequency of visits to the station with food intake in the case of gilts may be due to the fact that the latter generally received only 80 % of the older sows' ration, and that a majority of gilts only visited the station later in the day, once the older sows had left.

With an average 99.9 visits per day, visits to the station without food intake were approximately twice as frequent as those with food intake. There were no significant differences between parities. From Fig. 3 we can also see that a quarter of the sows from the third parity onwards visited the stations extremely frequently without food intake (between 150 and 900 times per day). One-quarter of the younger sows also visited the station over 100 times a day without food intake.

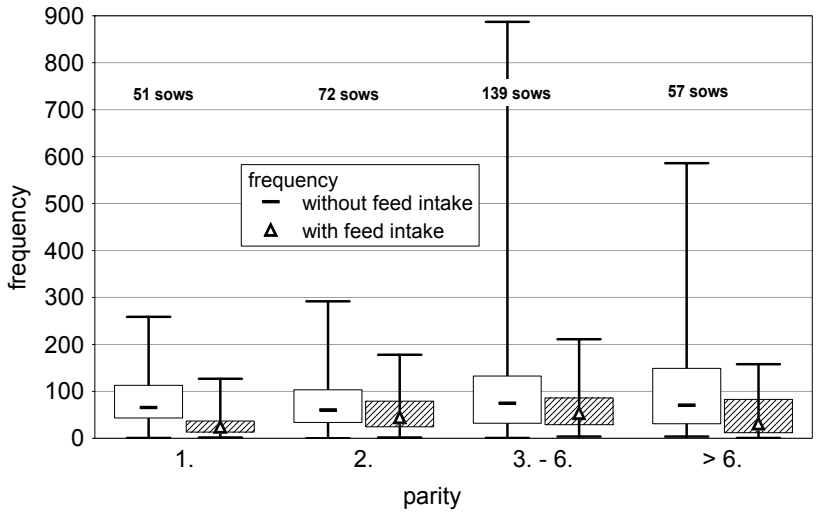

Fig. 3: Frequency of visits to the station per sow and day with and without feed intake, broken down according to parity. Minimum, quartiles, median and maximum are shown.

Viewed over the entire day, the sows visited the stations for an average of 42.5 minutes (no significant differences between parities), of which 22.5 minutes were devoted to feed intake. The gilts tended to require less time to feed, since they received less feed on the whole. The average duration of visits to the station without feed intake was 19.9 minutes, with significant differences ($p=0.01$) existing between parities (Fig. 4).

One-quarter of the oldest sows occupied the stations between 30 and 90 minutes per day without feeding. One-quarter of the sows between the third and sixth parity were in a similar range. It is striking that the first-parity sows generally had somewhat longer visiting times without food intake. This in turn may be connected with the fact that a proportion of these animals only appeared in the feeding area when the older sows were no longer there, so they would not be disturbed by the latter.

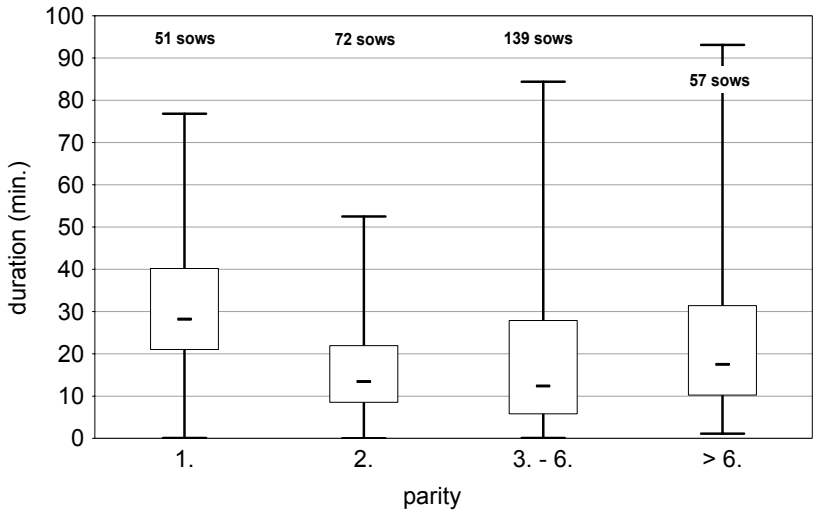

Fig. 4: Duration of visits to the station per sow and day without feed intake, broken down according to parity. Minimum, quartiles, median and maximum are shown.

3.3. Time of access to feeding stations after the start of feed distribution

Time of access to feeding station after the start of feed distribution revealed a scenario clearly broken down according to age (Fig. 5). The oldest, and therefore highest-ranking sows were the first to feed. Half of the low-ranking gilts were only able to feed between four and eight hours after the start of feed distribution, once no older sow had any remaining feed credit. A further quarter of the gilts were much later than this in feeding.

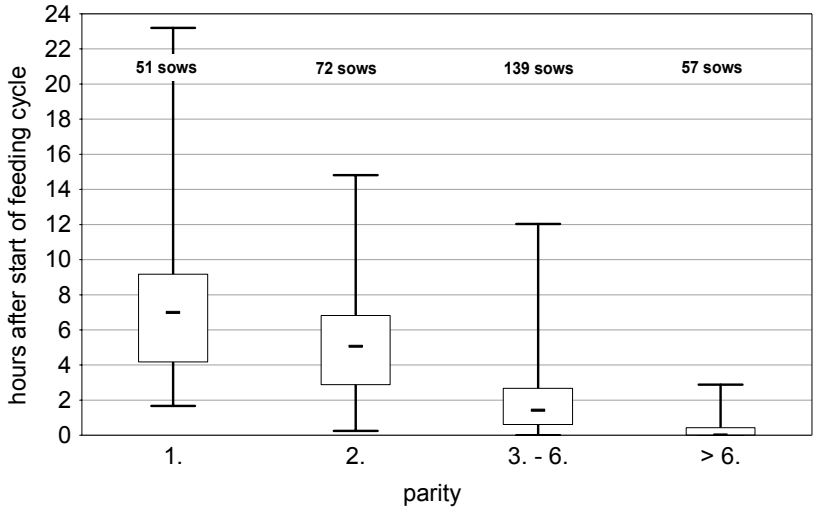

Fig. 5: Beginning of feeding after the start of the feeding cycle, broken down according to parity. Minimum, quartiles, median and maximum are shown.

3.4. Aggressive interactions at the feeding stations

Parity had a significant influence ($p<0.01$) on both types of aggressive interactions recorded (with and without retreat). Gilts and second-parity sows displayed little or no aggression, and instead retreated from the station. By contrast, aggressive behaviour of this sort was frequently observed in older sows (26.8 instances per animal and day in sows between the third and sixth parity, and 22.7 in sows over sixth parity). A similar picture emerged for aggressive behaviour in which the sow at the station did not relinquish her place ($p<0.01$). Only 0.2 such interactions were observed per animal and day in gilts, whilst the figure was 9.9 in the case of the oldest sows.

If we look at the box-plots of total aggressive interactions (the sum-total of aggressive interactions with and without retreat; Fig. 6), we are struck by the fact that one-quarter of the older sows committed between 40 and 160 aggressive acts per day. Between 40 and 80 aggressive acts per day were also observed in one-quarter of the sows between third and sixth parity.

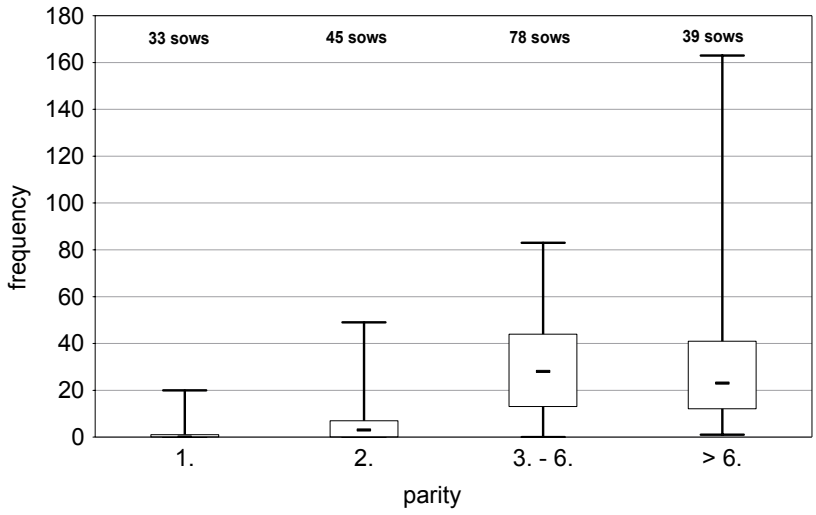

Fig. 6: Total frequencies of aggressive interactions (sum total of aggressive interactions with and without retreat) per sow and day at the nipple feeder stations, broken down according to parity. Minimum, quartiles, median and maximum are shown.

3.5. Clinical examinations of the sows

In the case of the ESF system with closed feeding station, all categories of sow exhibited changes of severity grade 2 at the end of gestation with equal frequency (Fig. 7). On average, between 3.5 % and 6.0 % of body regions were affected per animal. Where feed was dispensed via a nipple feeder, younger, low-ranking sows in particular exhibited a high per-

centage of changes of severity grade 2. On average, this finding could be observed in 38.5 % of the body regions of 1st-parity sows and 42.7 % of the body regions of 2nd-parity sows. In high-ranking older sows (>6th parity), only 8.3 % of body regions were affected by changes of severity grade 2. An intermediate position was occupied by sows in their 3rd to 6th parity, with 22.2 % of body regions affected. Differences between the two feeding systems as well as those between the different parities in the case of the nipple feeder were significant ($p<0.001$).

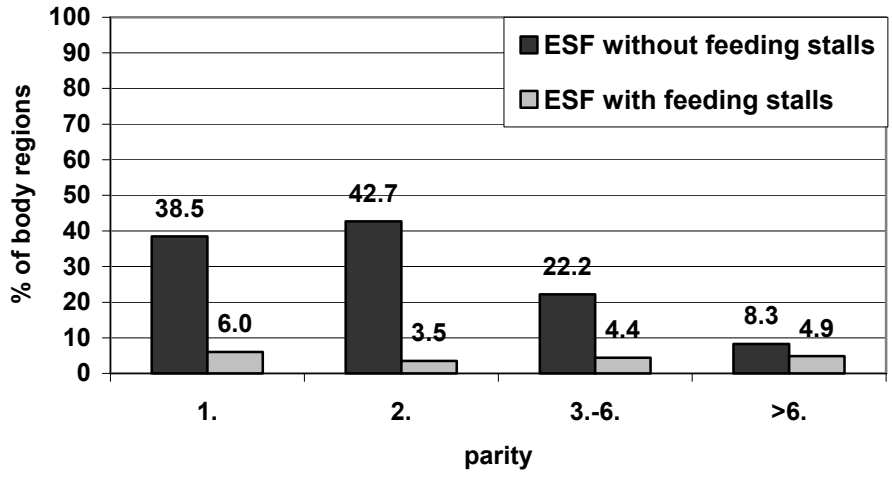

Fig. 7: Percentage of body regions with severity grade 2 changes at the end of gestation in the case of ESF with closed feeding station and nipple feeder, broken down according to parity

4. Discussion

4.1. Other studies on feeding systems without feeding stalls

Only very few studies are available on ESF systems without confinement during feeding. Surveys on an older model of nipple feeder produced similar results (Ibscher, 2000; Weber *et. al.*, 2002). Beckert (2003) studied the distribution of feed by nipple feeder under practical conditions on two farms. Sows visited the feeding stations per animal and day 15.9 and 16.2 times respectively with feed intake, and 12.3 and 14.1 times respectively without feed intake. Twenty-five and 24.8 aggressive interactions with retreat were counted respectively per animal and day, as well as respectively 5.5 and 8.0 aggressive interactions without retreat per animal and day.

Cielejewski and Feller (2001) electronically recorded the visits to the nipple feeder station in two pens with 11 to 16 sows and one nipple-feeder station per pen. This paper lists the number of daily visits paid by four sows to the nipple feeder station. On average, they visited the nipple feeder 60 times per day (range: 26-112), with 43 of these visits (range: 21-68) involving feed intake. The total duration of visits to the station with feed intake was 47 minutes per animal and day.

Jais (2000 and 2001) studied the behaviour of a group of ten sows at a nipple feeder station and two groups of 20 sows each at two nipple feeder stations. Per sow and day, 6.1 visits were recorded with food intake, and 7.3 without food intake. In this study, sows left the station against their will in 41 % of visits.

Rudovsky and Büscher (2002) studied the 'Belados' feed distribution system, in which the sows are likewise not confined in during feed intake, in a group of 27 sows. This system differs from the nipple feeder system in that the feed is dosed out into a closed trough. The sows visited the feeding station between 0 and 37 times per day, with feed being consumed in only 50 % of the visits. Duration of feeding ranged between 18 and 25 minutes per sow and day. High-ranking sows consumed their ration in one to three visits; gilts were frequently displaced and required over 15 visits to the station to consume their ration.

4.2. Comparison with ESF systems with closed feeding station

Many studies on conventional ESF systems with closed feeding station (individual ESF) are known. With this system, aggressive interactions typically occur in the waiting area of the feeding station. More or fewer aggressive interactions may be observed depending on the number of animals per station, available space, and possibility of being kept occupied. Systems of this type are allowed in Switzerland with 36 sows per feeding station. In a study (Weber and Friedli, 1991) in which 32 sows at one feeding station were housed in the same

pen and with the same management as in the study dicribed here, 5.7 aggressive acts per animal and day were counted in the waiting area. This frequency corresponds to one-third of aggressive interactions in the case of food dispensing via a nipple feeder. The percentage of body regions with injuries occasioned by aggressive interactions was many times lower than with food-dispensing via a nipple feeder.

5. Conclusions

In the ESF systems studied, sows are not protected from other animals during feed intake. It is hence very frequently possible for high-ranking sows to displace lower-ranking penmates from the feeding station with the aim of snatching some feed. Aggressive interactions in the feed-intake area are thus many times more frequent than for ESF systems in which sows are confined during food intake. The results of the study show that the use of ESF systems in which breeding sows are not be protected from penmates during feed intake must be judged critically in terms of animal welfare. Low-ranking sows in particular are very frequently displaced from the station.

6. References

Beckert, I., 2003: Fressverhalten von Zuchtsauen bei Gruppenhaltung. Ethologische Untersuchungen auf schweizerischen Praxisbetrieben bei der Fütterung mittels Breinuckel 'FITMIX' Modell 2002. Master's Thesis. Technical University of Munich, Center of Life Science, Institute of Animal Hygiene. 106 pp.

Cielejewski, H. and Feller, B., 2001: Gruppenhaltungsverfahren für tragende Sauen mit Breinuckelfütterung. In: Institute of Agricultural Engineering of the University of Hohenheim (Editor). Fifth International Conference on Construction, Engineering and Environment in Livestock Farming, 332-37.

Drickamer, L.C., Arthur, R.D. and Rosenthal, T. L., 1999: Predictors of social dominance and aggression in gilts. Applied Animal Behaviour Science **63** (2), 121-9.

Ibscher, A., 2000: Aggressionsverhalten und tageszeitliche Verteilung der Futteraufnahme von Galtsauen bei der Fütterung mittels Breinuckel. Master's Thesis. Swiss Federal Institute of Technology Zurich (ETHZ), Institute of Animal Sciences, Physiology and Animal Husbandry Group. 46 pp.

Jais, Ch., 2000: Haltung von tragenden Sauen am Breinuckel. Gruber Info, (4), 17-22.

Jais, Ch., 2001: Gruppenhaltung von Sauen am Breinuckel (Fitmix). In: Institute of Agricultural Engineering of the University of Hohenheim (Editor): Fifth International Conference on Construction, Engineering and Environment in Livestock Farming 506-9.

Hennig, R., 1998: Schwarzwild. Biologie, Verhalten, Hege und Jagd. BLV Verlagsgesellschaft mbH, Munich, Vienna, Zurich. 271 pp.

Morgan, C. A., Deans, L. A., Lawrence, A. B. and Nielsen, B. L., 1998: The effects of straw bedding on the feeding and social behaviour of growing pigs fed by means of single-space feeders. Applied Animal Behaviour Science **58** (1-2), 23-33.

Rudovsky, A. and Büscher, W., 2002: Fütterung tragender Sauen in Gruppenhaltung mit der Abrufstation Typ "Belados". Landtechnik **57** (5), 292-3.

Stolba, A. and Wood-Gush, D.G.M., 1989: The behaviour of pigs in a seminatural environment. Animal Production **48**, 419-25.

Weber, R. and Friedli, K., 1991: Abruffütterung für Zuchtsauen - Ergebnisse und Schlussfolgerungen. FAT Reports No. 410. Swiss Federal Research Station for Agricultural Economics and Engineering, Taenikon.

Weber, R., Ibscher, A. and Stauffacher, M., 2002: Aggressionsverhalten und tageszeitliche Verteilung der Futteraufnahme von Zuchtsauen am Breinuckel. In: Aktuelle Arbeiten zur artgemässen Tierhaltung 2001. KTBL-Schrift 407, 28-35.